Idaho Wellhead Protection Plan

Idaho Division of Environmental Quality

Idaho Wellhead Protection Work Group

February 1997

ACKNOWLEDGEMENTS

Many thanks to the members of the Idaho Wellhead Protection Work Group and the interested public. They have provided valuable input, comments, and support throughout the long and sometimes frustrating process of state plan development. This advisory group has been very helpful to the state, not only because they were able to balance policy development with the realities of implementation, but also because they worked with the conviction that this program will be able to make a positive difference to the environment and to the quality of life of all Idahoans.

We would also like to thank and acknowledge the Region 10 and Idaho Office of the U.S. Environmental Protection Agency, who have provided both financial and technical support for the development of this plan. Their assistance has been greatly appreciated.

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The acronyms that are used under the Program and Authority topics are listed below:

BMP	Best Management Plan
DWIMS	Drinking Water Information Management System
EDMS	Environmental Data Management System
EPA	United States Environmental Protection Agency
IDA	Idaho Department of Agriculture
IDEQ	Idaho Division of Environmental Quality
IDWR	Idaho Department of Water Resources
MCL	Maximum Contaminant Level
ppb	Parts per billion

Chapter One

Introduction

1.0 INTRODUCTION

Clean drinking water is essential to the citizens of Idaho. Since approximately 95 percent of Idaho's population uses groundwater for their water supply, its protection is vital to ensure the way of life that Idahoan's have come to expect and enjoy.

If the groundwater source that supplies a drinking water well becomes contaminated, or otherwise rendered unusable, the costs of replacing the well could become very expensive, if an alternate location can be found at all! It is, therefore, sensible to prevent the contamination of wells and wellfields by implementing wellhead protection concepts.

The Amendments to the Safe Drinking Water Act of 1986 established a Wellhead Protection Program to prevent the contamination of wells and wellfields that contribute water to public water supply systems. This document is a plan that lays the groundwork for the Wellhead Protection Program for the State of Idaho. The policies for the plan were developed by the Idaho Division of Environmental Quality (IDEQ) and the Idaho Wellhead Protection Work Group.

In 1989, the Idaho Legislature enacted the Ground Water Quality Protection Act. This act formed the Ground Water Quality Council, tasked with developing a Ground Water Quality Plan. This plan went out for public comment in the summer of 1991 and was adopted by the Legislature in March 1992. This plan calls for developing a statewide Wellhead Protection Plan.

Wellhead protection requires a unique partnership between the different levels of government. The decision and responsibility for protecting a community's ground water supply rests substantially with the local community. The State of Idaho is responsible for the development and implementation of a state wellhead protection plan that meets the requirements of the Safe Drinking Water Act Amendments. The State intends to provide technical assistance and guidance to local governments and water system purveyors. Currently both state and federal funding for wellhead protection are limited, but sources will be sought to allow continued implementation of the plan.

The federal government is responsible for approving state wellhead protection plans and for providing technical assistance to states and local governments. In addition, the federal government has provided financial assistance to Idaho to develop and begin implementation of this plan and has provided grants to local governments for wellhead protection demonstration projects.

The purpose of the Idaho Wellhead Protection Plan is to describe how the State of Idaho intends to meet wellhead protection requirements of the Safe Drinking Water Act Amendments of 1986. From this document, guidance will be developed to assist local governments and water system purveyors in developing a wellhead protection program that fits local conditions and the needs of their particular water system. By working together, local and state governments can implement the programs necessary to protect ground water.

Chapter Two

Program Summary, Purpose and Development

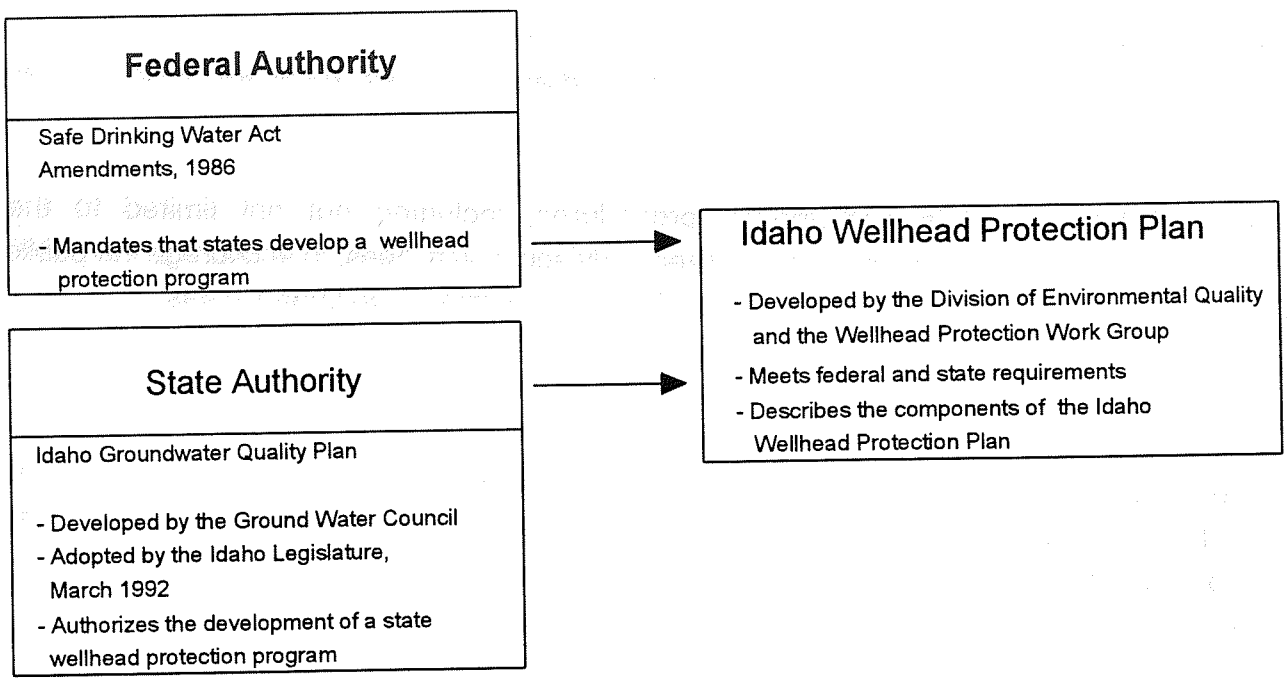
2.0 PROGRAM SUMMARY, PURPOSE AND DEVELOPMENT

2.1 PROGRAM SUMMARY AND PURPOSE

The purpose of the Idaho Wellhead Protection Program is to prevent the contamination of ground water that is used for drinking water. This includes the ground water which supplies existing drinking water wells and springs as well as the ground water around sites identified for future drinking water wells. This plan describes how Idaho will meet the requirements of the wellhead protection program as established by the Safe Drinking Water Act Amendments of 1986, Section 1428 and the requirements of the Idaho Ground Water Quality Plan relative to the Wellhead Protection Plan. Guidance will be developed from the policies of this plan which will assist local governments and water purveyors in implementing local wellhead protection programs.

The relationship of the Idaho Wellhead Protection Plan to the Safe Drinking Water Act Amendments of 1986 (Appendix A) and the Idaho Ground Water Quality Plan is illustrated in Figure 2.1. The Ground Water Quality Plan is a result of the Idaho Ground Water Protection Act, 1989 (Appendix B). Not only has the Idaho Wellhead Protection Plan been developed to meet the federal and state requirements, but it has also been developed because preventing the contamination of drinking water is a concept that the residents of Idaho support.

Figure 2.1 Federal and State Authority for the Wellhead Protection Program



Section 1428 of the 1986 Safe Drinking Water Act Amendments requires that each state program shall address the following components:

- Specify the duties of state agencies, local governmental entities, and public water supply systems with respect to the development and implementation of programs required by this section;

- Determine the wellhead protection area for each wellhead, as defined in subsection (e) based on all reasonably available hydrogeologic information on ground water flow, recharge and discharge and other information the State deems necessary to adequately determine the wellhead protection area;

- Identify within each wellhead protection area all potential anthropogenic sources of contaminants which may have any adverse effect on the health of persons;

- Describe a program that contains, as appropriate, technical assistance, financial assistance, implementation of control measures, education, training, and demonstration projects to protect the water supply within wellhead protection areas from such contaminants;

- Include contingency plans for the location and provision of alternate drinking water supplies for each public water system in the event of well or wellfield contamination by such contaminants;

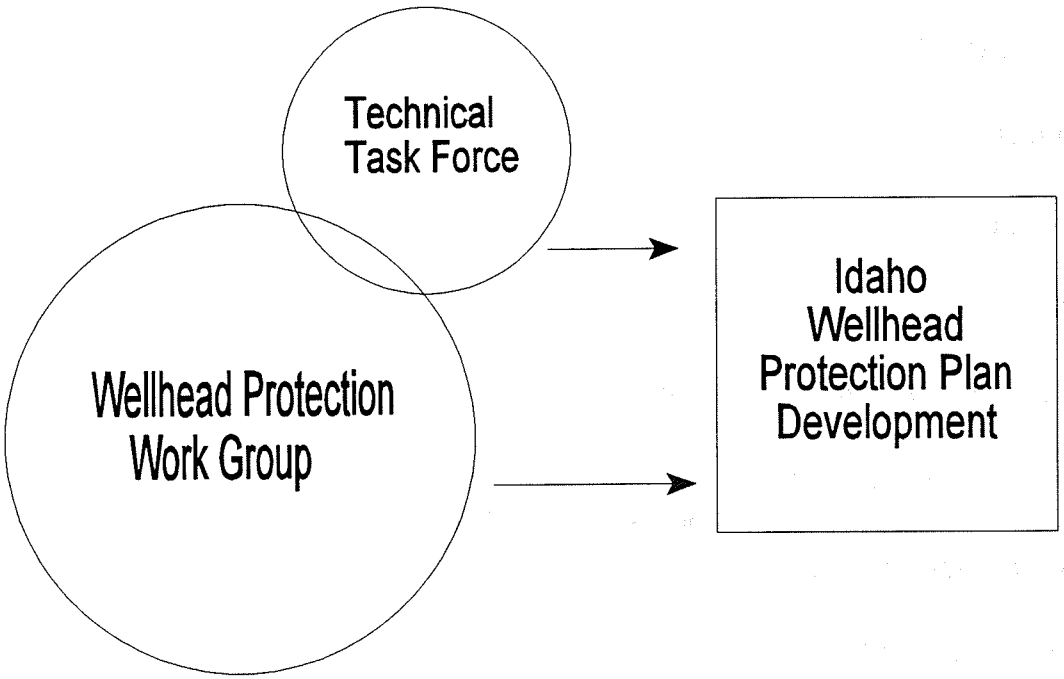
- Include a requirement that consideration be given to all potential sources of such contaminants within the expected wellhead area of a new water well which serves a public water supply system; and

- Establish public participation procedures, including but not limited to the establishment of technical and citizens advisory committees, to encourage the public to participate in developing the protection program for wellhead areas.

2.2 PROGRAM DEVELOPMENT

Two citizens advisory groups participated in the development of the Idaho Wellhead Protection Plan and will continue to work, as needed, with IDEQ, throughout plan implementation. These two groups are the Wellhead Protection Work Group and the Technical Task Force (Figure 2.2).

Figure 2.2 Citizen Advisory Groups that Developed the Idaho Wellhead Protection Plan



2.2.1 Wellhead Protection Work Group

The Wellhead Protection Work Group was composed of a wide spectrum of members representing water purveyors, irrigation users, cities, counties, citizens groups, building contractors, health districts, water well drillers, and state and federal agencies. A list of the official membership is in Appendix C.

The main function of the Wellhead Protection Work Group was to recommend policies and finalize technical decisions for the plan. The Wellhead Protection Work Group met on a regular basis between August 1991 and June 1992.

2.2.2 Technical Task Force

The Technical Task Force was a subgroup of the Wellhead Protection Work Group and was composed of engineers, hydrologists, hydrogeologists, geologists, and environmental scientists.

The function of the Technical Task Force was to develop technical recommendations, which were then considered by the Wellhead Protection Work Group for final approval. These participants are noted with an asterisk on the list of official members included in Appendix C. This group met several times between June 1991 and March 1994.

2.2.3 Other Participants

All meetings were open and there were several public participants who contributed significantly to the plan development. A list of these participants and their affiliations are in Appendix C.

2.3 GENERAL PROGRAM POLICIES

2.3.1 Review Process for the State Plan

IDEQ is responsible for reviewing, evaluating, and modifying the Idaho Wellhead Protection Plan. The Wellhead Protection Work Group and Technical Task Force will be updated on program progress and problems and will be consulted as needed.

2.3.1.1 Rationale/Discussion

Because the Wellhead Protection Program is developing, the plan that defines the program today may require changes or additions in the future. A process to review, evaluate, and modify the state plan is essential to address problems and concerns, as the need is demonstrated.

2.3.2 Program Type

The State has chosen to develop a program that is **voluntary** for local governments and water suppliers to implement. A voluntary program means that all communities and water suppliers are encouraged, but not required to develop a local wellhead protection program.

This approach will best meet the goals of the Wellhead Protection Program in consideration of the following circumstances:

- No authority exists for a mandatory program;
- Legislative restrictions exist on the stringency of the Drinking Water Program;
- Planning and zoning authority is lacking in some parts of the State;
- Limited technical assistance and funding is available for communities;
- Limited funding is available for the program;

- A general need exists for ground water protection education;
- There is a wide diversity in system sizes and needs; and
- A large percentage of Idaho's population uses private drinking water systems.

In addition, this approach is consistent with the prevention policy of the Ground Water Quality Plan, 1992, which states that "Voluntary prevention programs that stress education and technical assistance are preferred. Regulatory programs should be developed when voluntary programs are not successful in preventing ground water contamination..."

2.3.2.1 Rationale/Discussion

It was important to the Wellhead Protection Work Group to develop a program that was flexible and simple such that implementation at the local level could be attainable, the program could be administered with limited resources, and would emphasize education. This required that current and anticipated circumstances be evaluated so that appropriate and practical policies would be developed.

2.3.3 State Review and Certification Process for Local Plans

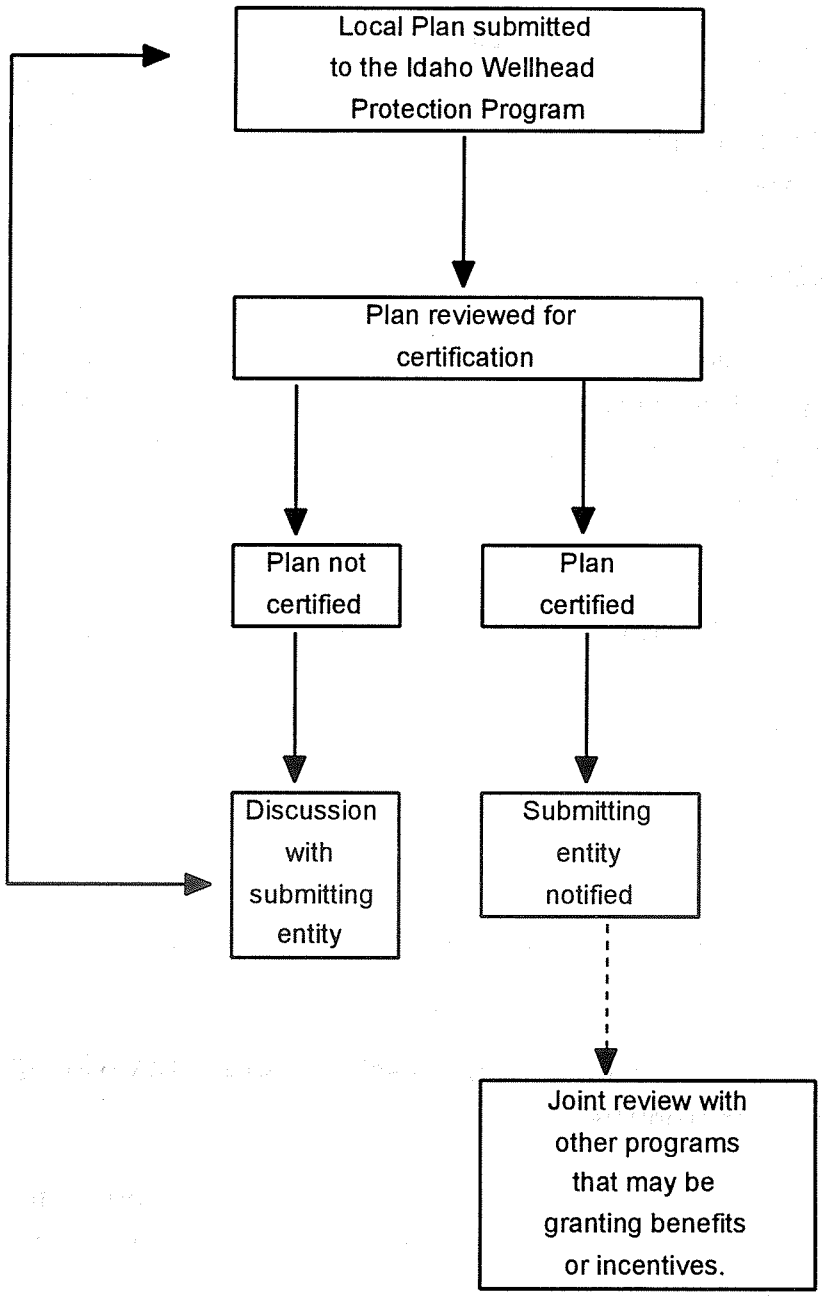
IDEQ will review local wellhead protection plans and program elements to the extent practical with available resources and staff. This process will include feedback and advice to the local entity submitting information. The review and certification process of wellhead protection plans is outlined in Figure 2.3.

Those plans which meet the following guidelines will be designated as "State Certified Plans."

- Address all elements of a wellhead protection plan as shown in Figure 2.4; and
- Are technically appropriate.

Entities with local wellhead protection plans that have received certification by IDEQ are not automatically ensured that drinking water monitoring waiver benefits or any other benefits will be issued. However, a certified local wellhead protection plan will expedite the evaluation of drinking water monitoring waiver requests. These monitoring waiver requests may be related to chemical compounds or may help a system comply with requirements under the Surface Water Treatment Rule if groundwater is found to be under the influence of surface water.

Figure 2.3. Review and Certification Process of Wellhead Protection Plans

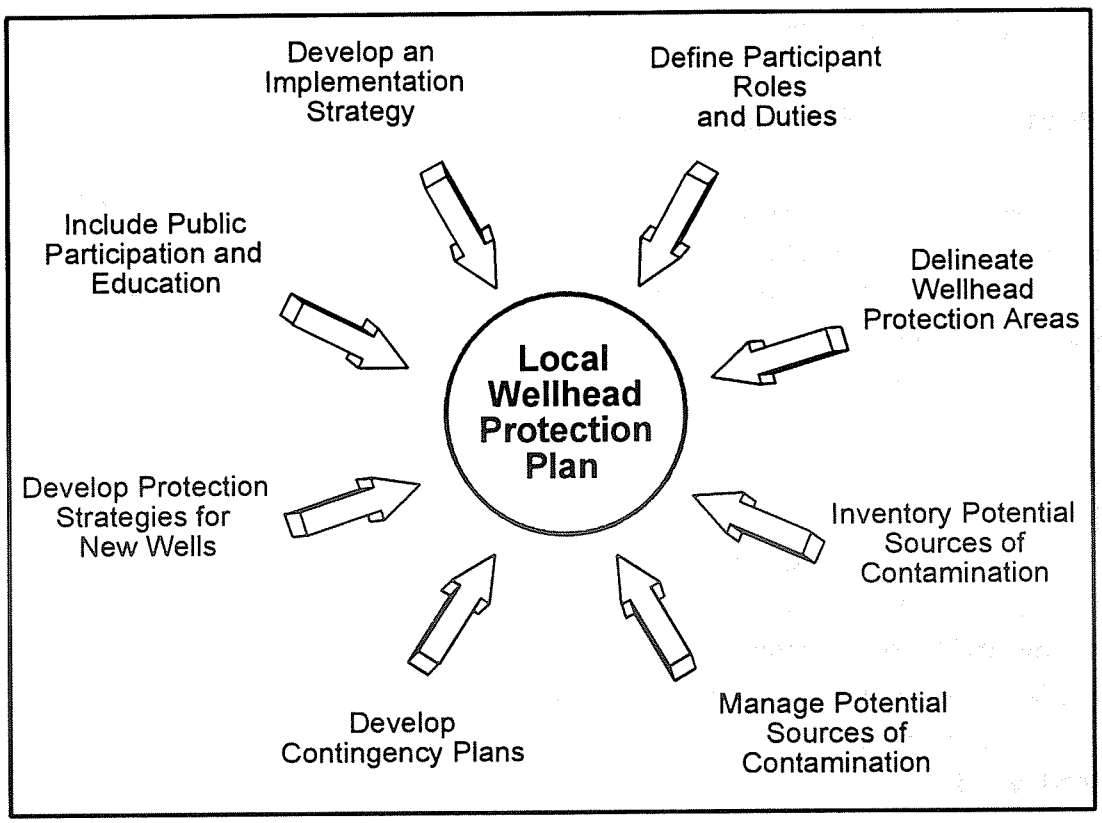


------► Performed only if pertinent

Communities should notify IDEQ if there is an intent to use a certified wellhead protection program as a basis to apply for related drinking water monitoring waivers. IDEQ can assist in local wellhead protection program development and will coordinate program reviews to assure feedback and advice that is consistent with state drinking water requirements.

A community whose local wellhead protection plan has been certified will be notified by IDEQ in writing.

Figure 2.4 Elements of a Certified Wellhead Protection Program



2.3.3.1 Rationale/Discussion

Even though the Idaho Wellhead Protection Program is voluntary for local governments and water purveyors to implement, the Wellhead Protection Work Group decided, with the concurrence of several local community representatives, that reviews of local plans and program elements were desirable. The local community representatives indicated that they would like feedback and advice on their plans and programs.

Local plans will be certified by IDEQ to assure a minimum standard. State certification will assist in the coordination of the Wellhead Protection Program with other ground water related programs. However, the criteria to receive benefits from other programs will be established by the specific program issuing the benefit, not the Wellhead Protection Program. As these criteria are established, the information will be incorporated into the Idaho Wellhead Protection Program guidelines.

Although related benefits or incentives may be available, the primary benefit that any community will receive if they initiate and implement a local wellhead protection plan is preventing the contamination of their drinking water supply. With the prevention of drinking water contamination, communities can therefore avoid public health impacts, expensive remediation, and possible well replacement.

2.3.4 Phasing and/or Prioritizing Procedure

Phasing in the program within the state and prioritizing implementation efforts will take into consideration the criteria listed below. These criteria will be taken into consideration if funding becomes available to assist local governments in implementing wellhead protection or if requests for technical assistance is much greater than can be provided. These criteria are listed in alphabetical order.

- Existing water quality
- Local support
- Need for technical assistance
- Percentage of ground water used for drinking water
- Vulnerability to contamination
- Water supplied by a Sole Source Aquifer
- Well construction
- Well yield

Chapter Three

Program Roles and Responsibilities

3.0 PROGRAM ROLES AND RESPONSIBILITIES

3.1 ROLES AND RESPONSIBILITIES FOR WELLHEAD PROTECTION

This chapter defines the roles and responsibilities of federal and state agencies, local governmental entities, and public water supply systems with respect to the development and implementation of the Idaho Wellhead Protection Program. These participants, in addition to the public, represent major partners of a wellhead protection program. This chapter also provides guidance on the formation of community planning teams.

3.1.1 Federal Agency Roles and Responsibilities

The U. S. Environmental Protection Agency (EPA) is responsible for approving state plans. In addition, the EPA has provided funding for states to develop state wellhead protection programs and has provided grants to local governments.

The EPA has the authority to administer the Sole Source Aquifer Program as established by Section 1424(e) of the Safe Drinking Water Act. A sole source aquifer is an aquifer which supplies at least 50% of the drinking water consumed in the area overlying the aquifer. In addition, there are also no alternative drinking water source(s) which could physically, legally, and economically supply all those who depend upon the aquifer for drinking water.

Three aquifers in Idaho have been designated as sole source aquifers, they are:

- Rathdrum Prairie Aquifer;
- Lewiston Basin Aquifer; and
- Eastern Snake River Plain Aquifer.

As a result of the designation, federal financially assisted projects over these aquifers are subject to review by the EPA in an effort to protect ground water quality. Federal efforts will be coordinated with state and local ground water protection efforts.

3.1.2 Agency Roles and Responsibilities

The Governor of Idaho has designated the IDEQ as the lead agency responsible for the Idaho Wellhead Protection Program. The letter authorizing this responsibility is included in Appendix D.

The responsibilities of IDEQ are listed below.

- Perform the duties as the lead state agency for the Idaho Wellhead Protection Program (duties include the development, coordination, and implementation of the Idaho Wellhead Protection Plan).

- Review and certify local wellhead protection plans as established by the policy guidelines discussed in Chapter 2.

- Provide technical assistance to public water supply systems and/or local governments on all aspects of the plan.

- Update Basic I wellhead protection area delineations for the five major hydrogeologic settings when appropriate.

- Delineate non-refined wellhead protection areas in fractured granitic or metamorphic rocks, carbonates, and other consolidated rock on a case-by-case basis as requested.

- Prioritize local government requests for federal or state grants should funding be available.

- Prioritize wellhead protection efforts based on the criteria listed in Chapter 2.

- Coordinate the program with other state agencies that are responsible for implementing regulations addressing potential contaminant sources in wellhead protection areas. A discussion of these agencies and associated responsibilities is discussed under the section on General Ground Water Roles and Responsibilities and in Appendix E.

- Provide public education on ground water protection, prevention of ground water contamination, and ground water restoration, in coordination with other state programs and agencies.

- Develop guidance manuals, forms, and other necessary material.

- Provide a biennial status report to the EPA as required by the Safe Drinking Water Act Amendments, 1986. A tracking system will be developed to assist IDEQ in meeting this requirement and in assessing progress of the program.

3.1.3 Local Roles and Responsibilities

The decision and responsibility for the protection of community water supplies rests substantially with the local government. Local governments are authorized to protect ground water by the:

- Idaho State Constitution, which allows a city and/or county to provide ground water protection through mechanisms (zoning, land use ordinances, etc.) appropriate to their authority to address local concerns and needs.

- Comprehensive Land Use Planning Act (1975), Idaho Code 67-6501 through 67-6537, which provides the framework for existing local planning activities. This act establishes that the responsibility of the city and/or county, through comprehensive planning, is to protect the health, safety, and welfare of its citizens. Elements to be covered in a comprehensive plan include population, economic development, land use, natural resources, hazardous areas, public facilities, transportation, recreation, special areas housing, community design, and implementation.

  Idaho Code 67-6537 specifically addresses the responsibility of local governing boards as it pertains to ground water quality in the area.

- Idaho Ground Water Protection Act of 1989; Idaho Ground Water Quality Plan, 1992, Policy IV-B, which states that all cities, counties and other political subdivisions of the state shall integrate the Ground Water Quality Plan in their existing programs and planning activities, and are also authorized and encouraged to implement ground water quality protection policies within their respective jurisdictions.

Local governments should have the following lead responsibilities, but these responsibilities should be in partnership with the water purveyor:

- Develop a local wellhead protection plan. It is recommended that this plan be incorporated in the local comprehensive plan;

- Coordinate the local roles and responsibilities;

- Inventory potential sources of contamination in wellhead protection areas;

- Develop a management strategy for potential sources of contamination within wellhead protection areas;

- Plan and protect future wellhead protection areas for new wells;

- Assure public participation during the development and implementation of a local wellhead protection plan;

- Develop and coordinate an implementation strategy; and

- Integrate wellhead protection concepts with other existing and future land use ordinances.

3.1.4 Water Purveyor Roles and Responsibilities

Water purveyors have the following lead responsibilities, but these responsibilities should be in partnership with the local government.

- Delineate wellhead protection areas if the community chooses the Basic II or refined delineation approach approached in Chapter 4.

- Develop contingency plans for the location and provision of alternate drinking water supplies in the event of loss of a well(s), wellfield(s), or spring(s).

- Plan the locations of future water wells.

3.2 GENERAL GROUND WATER ROLES AND RESPONSIBILITIES

3.2.1 Government Agencies

A summary of the authorities of federal, state, and local government entities to control potential ground water contamination sources is given in Appendix E. This summary was prepared by IDEQ in cooperation with the Idaho Department of Agriculture (IDA) and the Idaho Department of Water Resources (IDWR), at the direction of the Ground Water Council for the development of the Idaho Ground Water Quality Plan.

3.2.2 Other Organizations

A wellhead protection program may also involve several non-regulatory agencies or organizations such as research groups, citizen groups, and community assistance groups.

Research groups will be valuable sources of hydrogeological and geological information in the state. This information will assist in the wellhead protection area delineation component of the program.

Many citizen groups are very involved in public education on ground water. Support for the wellhead protection program will occur only if the public understands what ground water is, how it becomes contaminated, how it can be protected, and what the consequences can be if the drinking water supply becomes contaminated.

Community assistance groups can offer various forms of services that may be applicable to local wellhead protection implementation.

3.3 COMMUNITY PLANNING TEAMS

To be successful, a wellhead protection program needs the cooperative efforts of people within the community. It will need to have the input and ownership of people who make decisions that affect the community, are interested in ground water, and/or will be affected by the program. To satisfy these needs, a community planning team should be established to facilitate development of a local wellhead protection program. The community planning team will be responsible for developing a local wellhead protection plan, initiating implementation efforts, and reviewing and revising the local plan as needed.

Due to the fact that many wellhead protection areas will lie, at least in part, outside of the jurisdiction of the community initiating the wellhead protection plan, interjurisdictional cooperation is often essential for effective wellhead protection. To help resolve multi-jurisdictional issues, the community planning team should include representatives from those jurisdictions with land use controls over the wellhead protection areas. In addition, many public water systems are owned or operated by private entities with little or no jurisdiction over the wellhead protection area. A community planning team is essential under such conditions.

The exact makeup of a community planning team will vary depending on the nature of the community. Some communities have included at least the following people or organization representatives on their teams.

- Public works director
- Mayor or city administrator
- Planning and zoning representatives (city and county)
- Business community
- State agencies and organizations involved with ground water quality protection
- Technical experts in hydrogeology, hydrology, or geology
- Home owner associations (with community wells)
- General public

You may also need to include members who represent significant interests within your community such as someone from the agricultural community or a local tribal council.

Chapter Four

Wellhead Protection Area Delineation

4.0 WELLHEAD PROTECTION AREA DELINEATION

One of the elements addressed by the Idaho Wellhead Protection Program is delineation of wellhead protection areas. Wellhead protection areas are defined as the surface and subsurface area surrounding a water well or wellfield through which contaminants are likely to move and reach the well or wellfield. Within these areas, potential sources of contamination should be inventoried and managed.

The Technical Task Force and the Wellhead Protection Work Group have developed the following policies related to wellhead protection area delineation.

4.1 WELLHEAD PROTECTION AREA GOALS

4.1.1 Background

Goals for the Idaho Wellhead Protection Program, and therefore the goals for wellhead protection areas, must be established so that appropriate and consistent methods will be selected. Three general goals are listed in the EPA Technical Assistance Document, "Guidelines for Delineation of Wellhead Protection Areas", that may be relevant to defining the delineation of wellhead protection areas. These three goals are as follows:

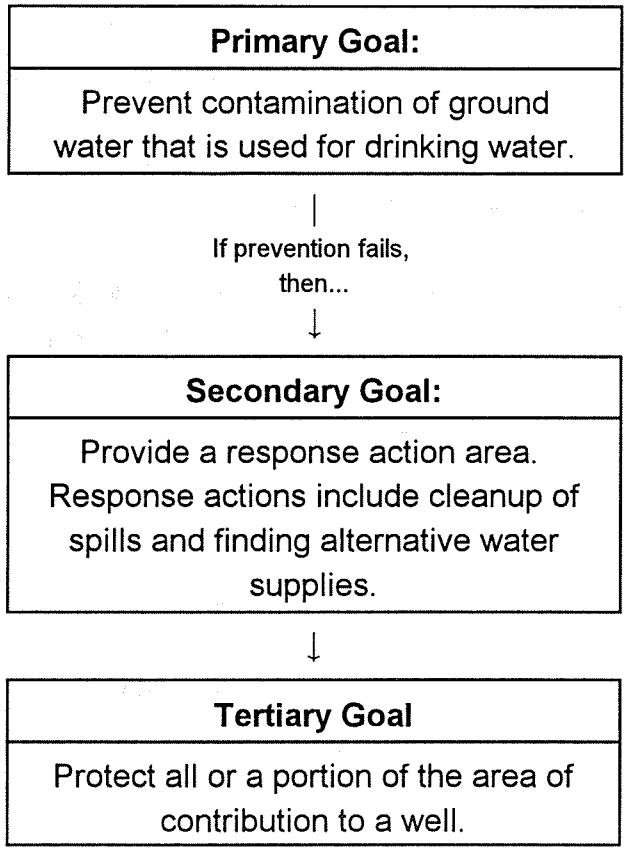
- Protect all or a portion of the area of contribution to a well;
- Provide a response action area to protect wells from unexpected contaminant releases; and
- Provide an area to allow attenuation of the concentrations of specific contaminants to desired concentrations by the time they reach the wellhead.

The delineation of wellhead protection areas alone cannot meet the goals of the wellhead protection program. This task must be combined with the other program components, such as source inventory and source management, to meet the overall goal of wellhead protection.

4.1.2 State Goals

Using the guidelines provided by the EPA, the Technical Task Force and the Wellhead Protection Work Group established a hierarchy of three goals for the Idaho Wellhead Protection Program. The wellhead protection goals for Idaho are outlined in Figure 4.1.

Figure 4.1. Wellhead Protection Goals for Idaho



The primary goal for the Wellhead Protection Program and wellhead protection areas in Idaho is to prevent the contamination of ground water that is used for drinking water. Prevention actions include implementing Best Management Practices (BMPs), using local ordinances, and providing public education or ground water protection.

A secondary goal is to provide a response action area. Response actions would be used when prevention is not always feasible or fails to address existing contamination problems. Response actions include ensuring adequate time to respond to a spill, cleaning up existing or new contamination problems, modifying BMPs if necessary, ensuring adequate time to install water treatment, finding interim and/or alternate sources of water supplies, and determining the area at risk.

The last goal selected by the Wellhead Protection Work Group is to protect all or a portion of the area of contribution to a well.

Attenuation of the concentrations of specific contaminants was not chosen as a goal for the Idaho program.

4.1.2.1 Rationale/Discussion

One of the policies established by the Idaho Ground Water Quality Plan (1992) is to prevent contamination of ground water from all regulated and non-regulated sources of contamination to the maximum extent practical (Policy II - A). The rationale for this policy is that the prevention of contamination is generally much less costly than cleanup, complete cleanup often is impossible, and the ground water may be impaired on a long term basis.

The Idaho Wellhead Protection Program is an implementation tool of this policy; therefore, it should follow that the primary goal for the program is to prevent contamination of ground water that is used as drinking water. Contamination can result from both point and non-point sources such as landfills, underground storage tanks, hazardous waste sites, septic tanks, storm water runoff, fertilizer and pesticide application, and underground injection wells. Prevention implies using proactive measures to keep ground water from becoming contaminated from all point and non-point sources.

Because prevention of ground water contamination is not always feasible, or there may be existing contamination problems, a secondary goal for wellhead protection areas is to provide a response action area. Contamination problems within any wellhead protection area should be a priority for cleanup to prevent water quality impacts at the wellhead. Also, if necessary, the wellhead protection area should ensure adequate time to respond to a release, treat the water, or find other sources of drinking water before the actual wellhead is impacted.

The last goal is to protect all or a portion of any area of contribution to a well. Protection of these land areas around wellheads will focus mainly on pollution prevention and education efforts.

4.2 TYPES OF WATER SUPPLIES

4.2.1 Background

Water wells supplying a public water supply system need to be identified so it is understood which water wells are relevant to the Wellhead Protection Program.

Protection of public water supply wells is only a minimum requirement of a state Wellhead Protection Program. Broad program goals could include protection of non-public wells

4.2.2 Water Supplies Relevant to the Idaho Wellhead Protection Program

The Idaho Wellhead Protection Program applies to both public and non-public water supplies.

Public water supplies include:

- community wells or springs;
- non-community, non-transient wells or springs; and
- non-community, transient wells or springs.

Non-public water supplies include:

- non-public wells (such as a private home) and
- non-public springs.

Table 4.1 outlines the different types of drinking water supplies, the Idaho definition, and the intent of the Wellhead Protection Program for that supply type.

Table 4.1 Drinking Water Supply Types in Idaho

Water Supply Type	Idaho Definition	Intent of the Wellhead Protection Program
Public: Community	Public water systems that serve 15 connections or 25 of the same persons year round.	Appropriate wellhead protection area delineation, guidance, and education.
Public: Non-community, non-transient	Public water systems that are not community systems and that regularly serve at least 25 of the same individuals over 6 months of the year.	Appropriate wellhead protection area delineation, guidance, and education.
Public: Non-community, transient	Public water systems that serve a transient population, such as campgrounds, rest stops, or restaurants.	Appropriate wellhead protection area delineation, guidance, and education.
Non-public	Water systems that do not meet the public water system definition. These systems serve 25 or fewer people and serve 14 or fewer connections.	Guidance and education.

4.2.2.1 Rationale/Discussion

Since community and non-community, non-transient wells or springs serve the same population regularly for at least 6 months per year, it is important to protect the water quality for both acute and chronic health risk reasons. Non-community, transient

wells/springs should also be protected from contamination primarily for acute health risk reasons.

Non-public water wells are not regulated by the Idaho Rules for Public Drinking Water Systems. These types of wells serve approximately one-third of the state population as a year round source of drinking water (Idaho Department of Water Resources Water Use Database, May 1991; U.S. Census, 1990). Since non-public water wells serve a significant portion of the state population and are not regulated, these wells have been included in the plan with an emphasis on providing guidance and education for non-public well owners.

4.3 DELINEATION OF WELLHEAD PROTECTION AREAS

Wellhead protection areas are to be defined based on all reasonably available hydrogeologic information on ground water flow, recharge, discharge, and other information the State deems necessary.

4.3.1 Background

The system size distribution and drinking water violation data were two major factors that helped form the delineation guidelines. The intent was to develop guidelines that communities could attain and that would meet the goals of the program.

4.3.1.1 System Size

As of 1996 there were 2,499 regulated water systems in Idaho. Eight hundred thirty two (832) of these systems were community water systems, 304 were non-community, non-transient water systems, and 1,363 were non-community, transient water systems (Table 4.2).

Table 4.2 Regulated Water Systems in Idaho

Water System Type	Number of Water Systems	Population Served
Community	832	871,000
Non-community, non-transient	304	133,000
Non-community, transient	1,363	177,000
TOTAL	2,499	1,181,000

Source: DEQ Drinking Water Information Management System (DWIMS)

The sizes of the non-transient regulated systems are quite diverse: the majority of these systems (83%) serve less than 500 people each, 16% of the systems serve between 500 - 10,000 people each and 1% of the systems serve greater than 10,000 people each. It is important to note, however, that the larger systems serve a large percentage of the state population (Table 4.3).

Table 4.3 Sizes of Regulated Community and Non-Community, Non-Transient Systems in Idaho

Population per System	Number of Systems	Population Served
0 -100	562 (49%)	32,000 (3%)
101 - 500	389 (34%)	96,000 (10%)
501 - 10,000	183 (16%)	377,000 (40%)
> 10,000	12 (1%)	448,000 (47%)
TOTAL	1,136	953,000

4.3.1.2 Drinking Water Violation Data

A summary of the "Maximum Contaminant Level" and "Monitoring and Reporting" bacteriological violations in 1995 indicate that a majority of the violations occurred with the smaller drinking water systems (Tables 4.4 and 4.5).

Table 4.4 Bacteriological Compliance Report - Contaminant Violations in 1995

Bacteriological Compliance Statistics Report Contaminant Violations, 1995				
System Population Size	**# Violations**	**# of Systems With Violations**	**% of Total Violations**	**Potential Population Affected***
< 500	328	236	83.7	26,478
500 - 3,300	52	36	13.3	38,726
3,301 - 10,000	11	7	2.7	38,565
≥ 10,000	1	1	0.3	50,000
TOTAL	392	280	100	153,769

*Numbers based on entire system affected Source: DEQ - DWIMS

Table 4.5 Bacteriological Compliance Report - Monitoring and Reporting

Bacteriological Compliance Statistics Report Monitoring and Reporting Violations, 1995				
System Population Size	**# Violations**	**# of Systems With Violations**	**% of Total Violations**	**Potential Population Affected***
< 500	1941	951	93.5	89,520
500 - 3,300	102	61	4.9	85,820
3,301 - 10,000	20	11	1	62,063
≥ 10,000	12	3	0.6	55,116
TOTAL	2,075	1,026	100	292,519

* Numbers based on entire system affected.Source: DEQ - DWIMS

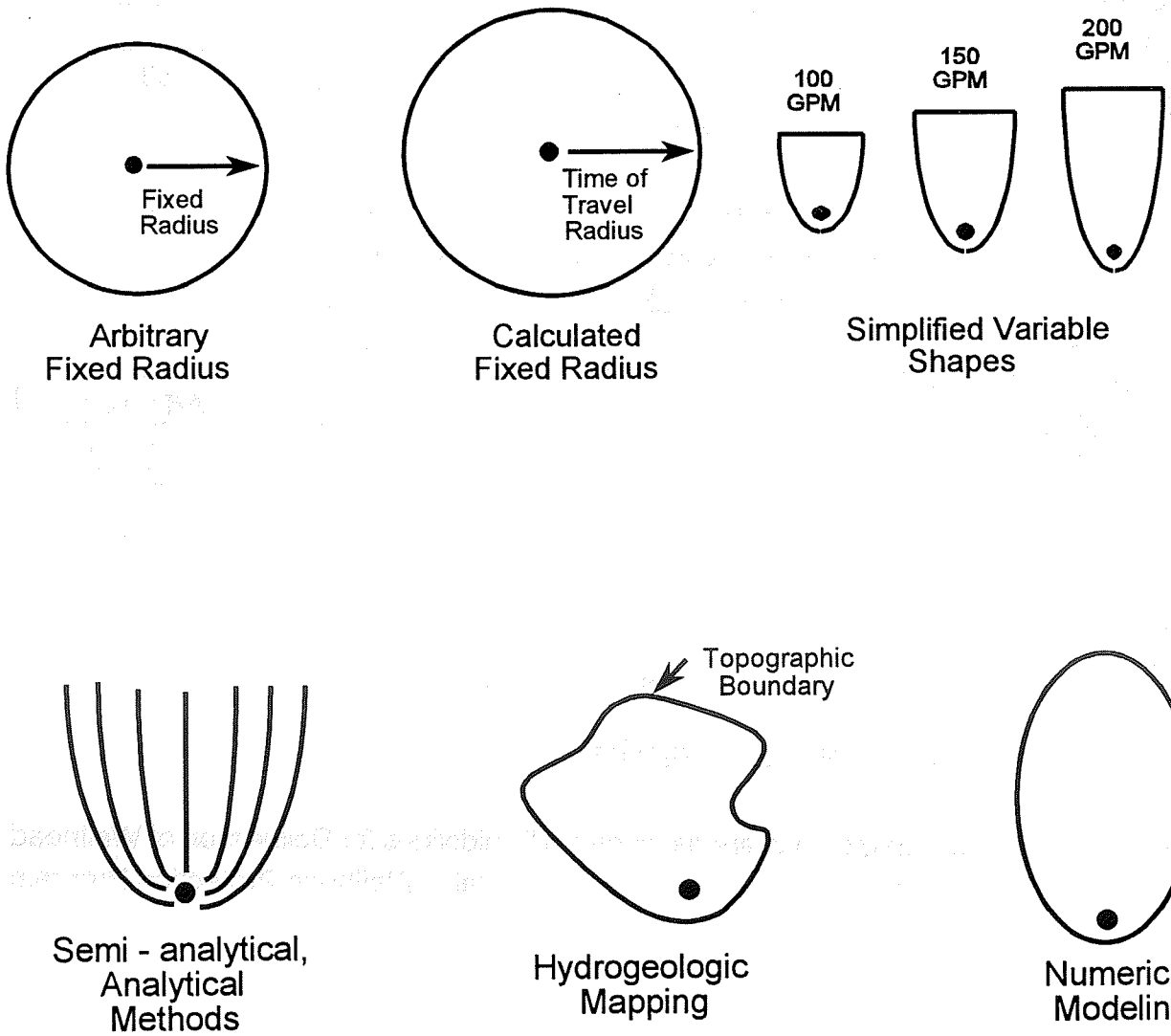
4.4 DELINEATION METHODS - OVERVIEW

The following delineation methods are described in "Guidelines for Delineation of Wellhead Protection Areas" and were considered for use in the Idaho Wellhead Protection Program (Figure 4.2):

- ♦ Arbitrary Fixed Radius;
- ♦ Calculated Fixed Radius;
- ♦ Simplified Variable Shapes;
- ♦ Analytical Methods;
- ♦ Hydrogeologic Mapping; and
- ♦ Numerical Flow/Transport Models.

All methods except arbitrary fixed radius and simplified variable shapes have been incorporated in the delineation approaches for the program. The advantages and disadvantages of the methods are discussed in some of the following sections.

Figure 4.2. Overview of Delineation Methods



4.4.1 Arbitrary Fixed Radius

The delineation of a wellhead protection area using the arbitrary fixed radius method involves drawing a circle around a well using an arbitrarily selected distance. This method is easily implemented, easily understood, inexpensive, and the data requirements are minimal. The major disadvantage is the degree of uncertainty due to the lack of scientific basis for the selection of the selected distance.

4.4.2 Calculated Fixed Radius

The delineation of a wellhead protection area using the calculated fixed radius involves drawing a circle for a specified time of travel threshold. The time of travel is calculated assuming that the particle of contamination is present in the aquifer.

This method is more accurate than the arbitrary fixed radius method as it is based on some scientific reasoning. The method has limitations, but can provide a low cost, easily understood, and easily applied method when site specific data are limited.

4.4.3 Simplified Variable Shapes

The simplified variable shape method uses "standardized forms" that are generated using analytical models that use flow boundaries and time of travel criteria. A "standardized form" is selected for hydrogeologic and pumping conditions similar to the wellhead of interest. The standard form is then oriented around the well according to the direction of ground water flow. The data input requires basic hydrogeologic properties and well pumping rates.

This method can be easily implemented once the standard forms are established. However, if data are lacking, then an appropriate form can not be confidently developed.

4.4.4 Analytical Methods

Analytical methods use equations to define the area of contribution to a pumping well in a sloping water table. Site specific hydrogeologic properties are required and can include transmissivity, porosity, hydraulic gradient, hydraulic conductivity, and saturated thickness of the aquifer.

The method uses equations that take into account site specific hydrogeologic properties, thus the accuracy is much greater than the arbitrary fixed radius, calculated fixed radius, and fixed shapes methods. This method can take into account hydrologic boundaries, but

implementation can be expensive if site specific data must be collected.The use of this method also requires more technical expertise.

4.4.5 Hydrogeologic Mapping

Wellhead protection areas can be mapped using geological, geophysical, isotope assessments, or dye tracing methods. Flow boundaries are defined by lithologic variation or permeability contrasts within the aquifer. This method is best suited for hydrogeologic settings dominated by near surface flow boundaries and for anisotropic aquifers, such as fractured bedrock. However, the disadvantage is that the method requires technical expertise to make judgement on what constitutes likely flow boundaries.

4.4.6 Numerical Flow/Transport Models

Wellhead protection areas can be delineated using computer models that approximate ground water flow or solute transport equations numerically. This method is especially useful where boundary and hydrogeologic conditions are complex and if site specific data are available. The method offers a potential high degree of accuracy, but can be expensive and requires hydrogeologic and modeling expertise.

4.5 DELINEATION APPROACHES IN IDAHO

4.5.1 General Description

Idaho has chosen a tiered delineation approach in consideration of the wide distribution of system sizes, the drinking water violation data, and in consideration of the factors that support developing a voluntary program, as discussed in Chapter 2. These factors also were the basis for the philosophy of the program, which especially applies to the delineation component of the program. The philosophy was to develop a flexible and simple program such that implementation at the local level could be attainable, the program could be administered with limited resources, and public education would be emphasized (Figure 4.3).

Figure 4.3. Philosophy of the Idaho Wellhead Protection Program

Program should be flexible and simple so that implementation can be attainable.

❖

Program must be able to be administered with limited resources.

❖

Program should emphasize public education.

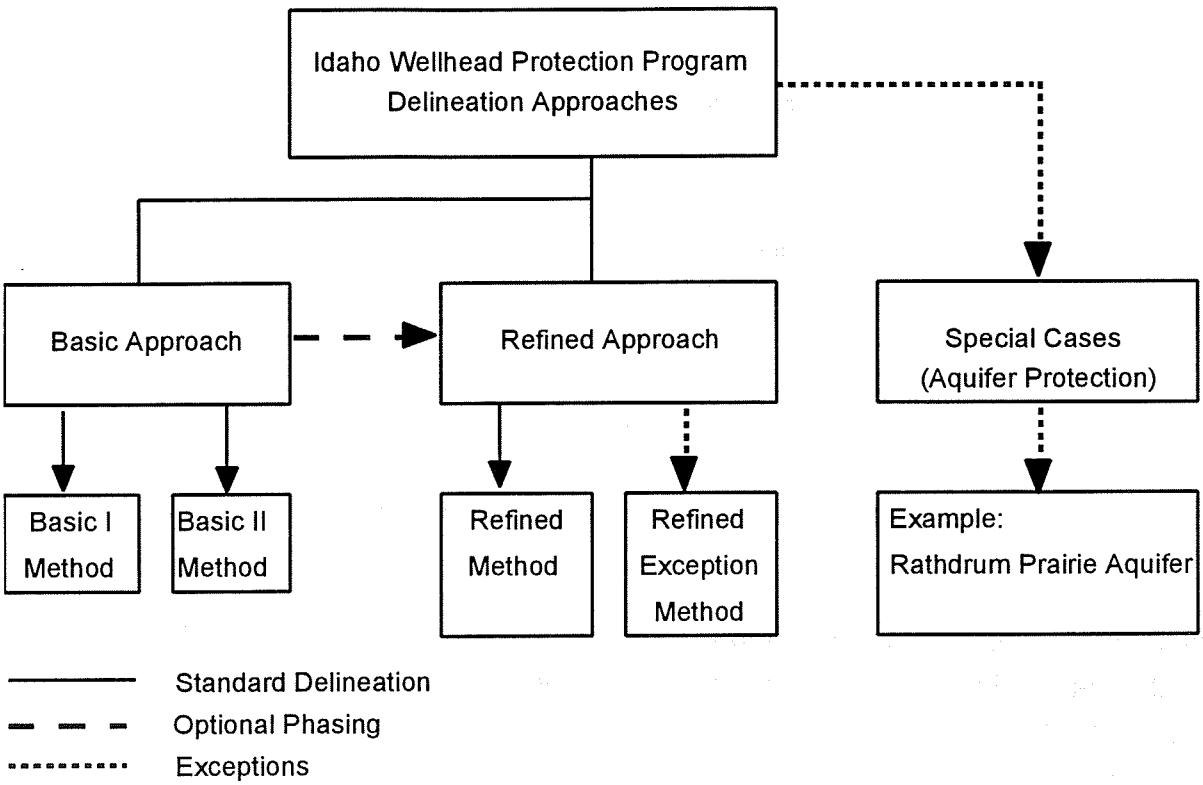
The delineation approaches for Idaho are shown in Figure 4.4. Local governments can choose the delineation approach that best meets their needs and resource availability to implement measures that prevent the contamination of their drinking water supply. An assessment guide has been developed to clarify the intent of these various approaches and will also assist local governments in choosing the most appropriate delineation approach and method (Figure 4.5).

IDEQ anticipates that the smaller communities will use the basic approach and the larger communities will tend to use the refined approach. Communities may choose to phase into the refined approach by first implementing the basic approach. Communities choosing to use the refined approach are not required to first implement the basic approach.

There are two exceptions to the standard delineation guidelines discussed above: the Refined Exception Method and Special Cases (aquifer protection). Communities who choose to utilize these options will need to meet the special conditions that are outlined later in this chapter.

Wellhead protection areas, regardless of the approach or method, are divided into zones that vary in distance from the physical wellhead. The specific details for these zones are discussed in the following sections.

Figure 4.4 Delineation Approaches for the State Program

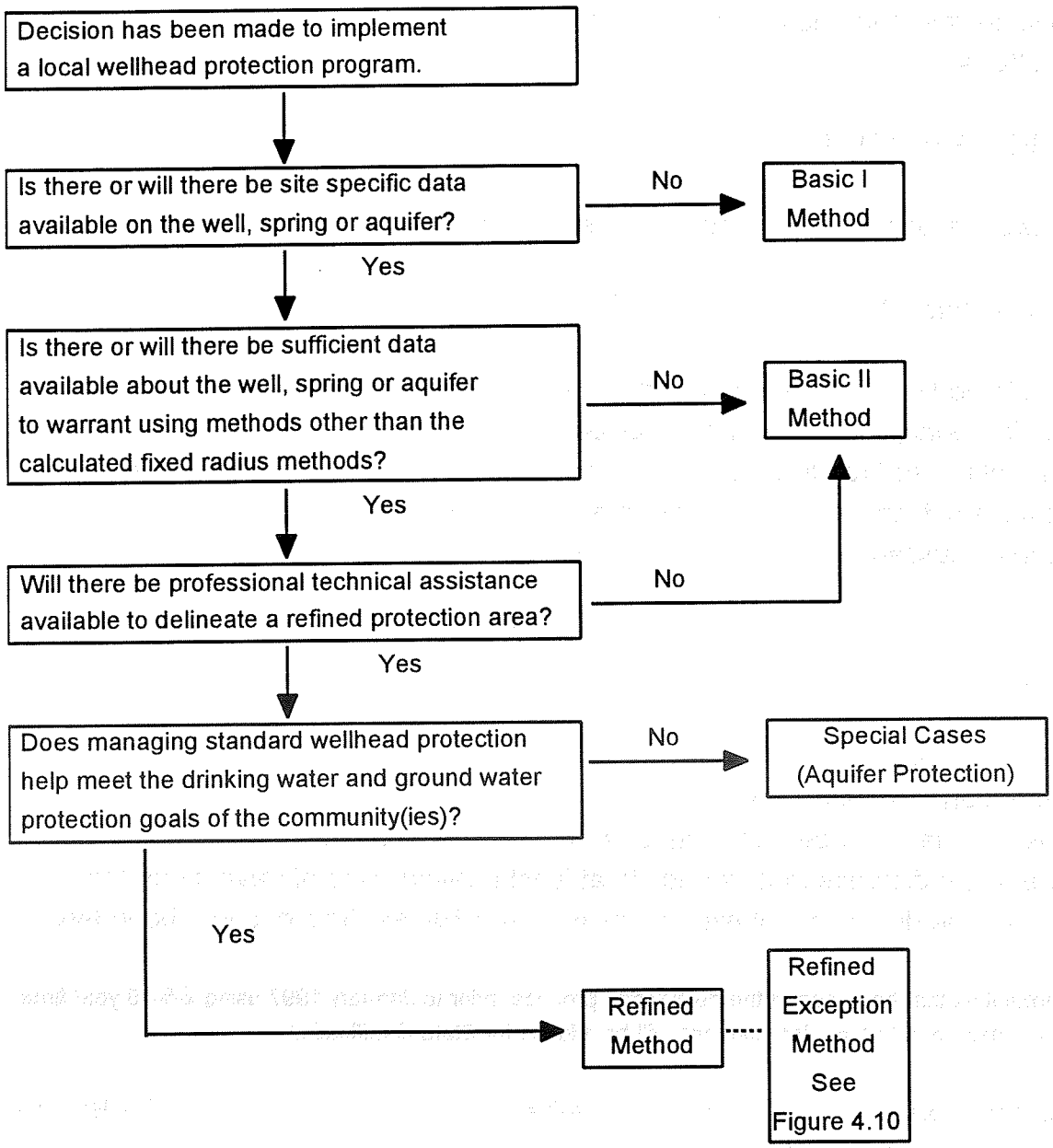


4.5.1.2 Rationale/Discussion

The tiered delineation approach will assist IDEQ in implementing the program as it offers maximum flexibility for program administration and implementation of a voluntary program when there is a wide diversity in system sizes with varying needs. The flexibility of the tiered approach allows communities to choose the delineation method based on whether the approach is appropriate for their water system and on economic considerations.

With the recent increase of monitoring requirements, the financial and administrative responsibilities on drinking water systems has increased significantly. In addition, the bacteria contaminant, monitoring, and reporting violation data for 1992 indicate that most of the infractions have occurred with the small systems, thus wellhead protection is particularly important for this group. This information further substantiates that the Idaho Wellhead Protection Program needs to provide affordable delineation options so that all systems may take advantage of the benefits of the program.

Figure 4.5. Assessment Guide to Select Appropriate Delineation Method



Although the level of accuracy of the delineation approaches vary, they all provide a geographic area within which potential sources of contamination can be inventoried and then managed. Since the management component of the program really is the most important part towards actual prevention of contamination, the guideline delineation approaches are justified and help Idaho meet the goals of the program.

The division of wellhead protection areas into zones allows flexibility in the management of potential sources of contamination. Sources that lie in the zones closest to the wellhead need to be managed as stringently as possible. Sources that lie within zones in intermediate distances from the wellhead can be managed less stringently. And finally, sources within the outermost zone should be managed, at a minimum, with public education efforts.

4.6 BASIC APPROACH

There are two methods that comprise the basic approach: Basic I and Basic II.

4.6.1 Basic I Method

The Basic I Method is a fixed radius based on calculations that uses generalized, available, existing hydrogeologic data for the major aquifers in Idaho and the peak sustainable pumping rate of the well (or flow rate of a spring). This method should be used when site specific data are not, and will not be, available. The data and equation used for the Basic I Method are discussed in detail in Appendix F.

Wellhead protection areas defined by the Basic I Method should be zoned as shown by Figure 4.6 and described in Table 4.6 and below:

- Zone IA: at least the sanitary setback distance for wells and springs as established by the Idaho Rules for Public Drinking Water Systems
- Zone 1B: the distance that extends to at least a 3-year time of travel boundary
- Zone II: the distance that extends to at least a 6-year time of travel boundary
- Zone III: the distance that extends to at least a 10-year time of travel boundary.

NOTE: Communities that have begun the delineation process, prior to January 1997 using 2-5-10 year time of travel boundaries based on earlier guidance will be eligible for State Certification.

The general procedure for delineating the wellhead protection zones using the Basic I Method is outlined in Figure 4.7.

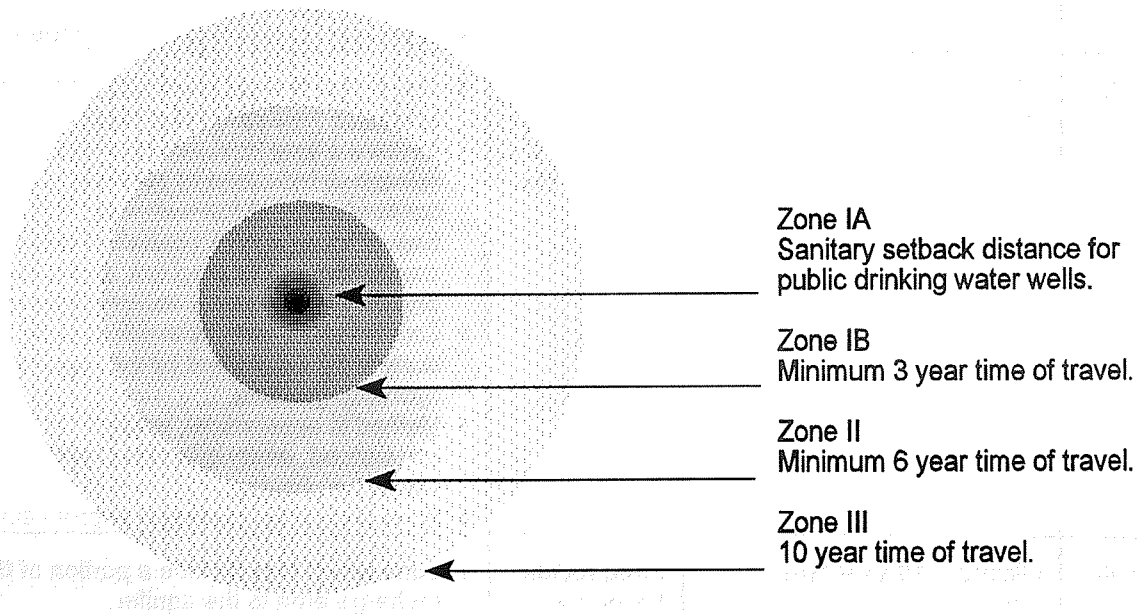
The Basic I time of travel calculations are based on five major hydrogeologic settings in Idaho.

- Eastern Snake River Plain Basalts
- Columbia River Basalts
- Unconsolidated alluvium

- Mixed volcanic and sedimentary rocks - primarily sedimentary rocks
- Mixed volcanic and sedimentary rocks - primarily volcanic rocks

The distances for the various time of travel boundaries for pump rates between 50 gallons per minute and 7000 gallons per minute are given in Tables 4.8a through 4.8e. The available data, the rationale for the data selected for calculation, and the method of calculation are discussed in Appendix F.

Figure 4.6 Wellhead Protection Zones for the Basic I Method



● - Well Location

Table 4.6 Wellhead Protection Zones Using the Basic I Method

Zone	Zone Boundary	Method(s)	Comments
Zone IA	Sanitary setback distance established in the Idaho Rules for Public Drinking Water Systems.	Fixed radius	♦ Distance is consistent with the sanitary setback distance for wells and springs. ♦ Zone should be very strictly managed.
Zone IB	Minimum 3-year time of travel.	Fixed radius based on generalized aquifer data.	♦ The 3-year time of travel allows adequate time for a community to develop an interim response[1] to a release or indication of pending contamination at the wellhead. This time of travel is also consistent with a monitoring waiver program, and may assist with monitoring waiver approvals. ♦ Ground water velocity in this zone is influenced by the pumping well. ♦ Method is economical, easily understood, easily quantified, and useful for phasing. ♦ Zone should be stringently managed.
Zone II	Minimum 6-year time of travel.	Fixed radius based on generalized aquifer data.	♦ The 6-year time of travel should allow adequate time for a community to develop a long term solution[2] to a release or indication of pending contamination at the wellhead. This time of travel is also consistent with a monitoring waiver program, and may assist with monitoring waiver approvals. ♦ Ground water velocity in this zone is likely to be dominated by the regional hydraulic gradient. ♦ Method is economical, easily understood, easily quantified, and useful for phasing. ♦ Zone should be managed appropriately.
Zone III	Minimum 10-year time of travel.[3]	Fixed radius based on generalized aquifer data.	♦ Zone which may include a portion of the recharge area to the aquifer. ♦ Ground water velocity in this zone is likely to be dominated by the regional hydraulic gradient. ♦ Method is economical, easily understood, easily quantified, and useful for phasing. ♦ Zone should, at a minimum, be managed with public education efforts.

[1] Examples: mitigating a contamination problem and providing interim alternative water supplies.
[2] Examples: remediating a contamination problem and finding a long term source of drinking water.
[3] In some cases, this area may need evaluation to ensure that it is within the known area of the aquifer.

Figure 4.7. Delineation Procedure for the Basic I Method

Basic I Method

Recommended Procedure for Delineating Wellhead Protection Areas

- ❑ Determine aquifer from which the well produces. Use references listed in Table 4.7.
- ❑ Determine the peak sustainable pumping rate of the well.
- ❑ Use the above information in conjunction with Tables 4.8a through 4.8e to determine the 3-, 6- and 10-year TOT boundaries.

Within each of the major hydrogeologic settings, a differentiation between unconfined and confined aquifers has not been made in the calculations, as sufficient data do not exist to determine the degree of confinement or unconfinement. Where multiple aquifers exist, some degree of vertical conductivity should be assumed in all cases.

Figure 4.8 shows the location of the major aquifer types in Idaho. These maps are a compilation of U.S. Geological Survey and Idaho Department of Water Resources (IDWR) publications. The references used for these maps are given in Appendix F.

This map, digitized at 1:500,000, shows only the major aquifers, and can only portray two dimensions. Thus, communities need to use other sources of information to more accurately identify the aquifer that provides the water for their well(s), especially if the well(s) is located at the aquifer boundary (ies). The original purpose of the map was for the administration of ground water rights and to establish the area of communication between ground water and surface water.

For the Wellhead Protection Program, the purpose of this map is to help communities that choose the Basic I Method to:

- ♦ get started, using the map as general guidance;
- ♦ assist them in visualizing where their community lies with respect to the aquifers in the area; and
- ♦ offer a perspective of the diverse hydrogeology in Idaho.

The Technical Task Force recommends that communities should determine the aquifer from which their wells produce by using all of the sources of information available. Suggested resources are shown in Table 4.7.

Granitic, carbonate, metamorphic, and other consolidated rock aquifers exist in Idaho but are considered to be minor aquifers. Basic I wellhead protection areas have not been calculated for these hydrogeologic settings due to a lack of data. IDEQ will evaluate and define wellhead protection areas, on a case-by-case basis, for wells or springs in these settings for those communities that elect to develop a local wellhead protection program using the basic approach. The method that will be used will be determined by the availability of data.

Table 4.7. Sources of Information to Determine the Producing Aquifer

Reference Source	Comments
County Planning and Zoning	♦ Aquifer information may be available for comprehensive planning.
Environmental Consultants	♦ Staff has knowledge of aquifers in the state.
Geological Surveys (State and Federal)	♦ Hydrogeologic and geologic reports by the U.S. Geological Survey and Idaho Geological Survey have detailed aquifer information.
Idaho DEQ, Central and Regional Offices	♦ Agency produces hydrogeologic reports. ♦ Staff has knowledge of aquifers in the regional districts and/or state.
Idaho Department of Water Resources	♦ Agency produces hydrogeologic reports. ♦ Well log information resides at the central office. ♦ Staff has knowledge of aquifers in Idaho.
Local well drillers	♦ Local well drillers may have old well logs and general knowledge of an area.
Universities and community colleges	♦ Faculty and students have knowledge of aquifers in Idaho. ♦ Hydrogeologic and geologic reports have detailed aquifer information.

Table 4.8 Fixed Radii for the Major Aquifers in Idaho

Table 4.8a

Eastern Snake River Plain Basalts										
Zone	Peak Pumping Rate (Gallons per Minute)									
	50 GPM	100 GPM	500 GPM	1000 GPM	2000 GPM	3000 GPM	4000 GPM	5000 GPM	6000 GPM	7000 GPM
Zone IA	Sanitary setback distance									
Zone IB (3 Yr. TOT)	2700'	2700'	3000'	3300'	3700'	4200'	4600'	5000'	5300'	5700'
Zone II (6 Yr. TOT)	5300'	5300'	5600'	5900'	6400'	6900'	7400'	7800'	8200'	8600'
Zone III (10 Yr. TOT)	8800'	8800'	9100'	9500'	10,100'	10,600'	11,100'	11,600'	12,000'	12,500'

TOT = Time of Travel

Table 4.8b

Columbia River Basalts										
Zone	Peak Pumping Rate (Gallons per Minute)									
	50 GPM	100 GPM	500 GPM	1000 GPM	2000 GPM	3000 GPM	4000 GPM	5000 GPM	6000 GPM	7000 GPM
Zone IA	Sanitary setback distance									
Zone IB (3 Yr. TOT)	300'	400'	1000'	1500'	2400'	3200'	4100'	4800'	5600'	6400'
Zone II (6 Yr. TOT)	500'	800'	1400'	2000'	3100'	4000'	4800'	5700'	6500'	7300'
Zone III (10 Yr. TOT)	600'	800'	1800'	2600'	3800'	4800'	5700'	6600'	7500'	8300'

Table 4.8c

Unconsolidated Alluvium										
Zone	Peak Pumping Rate (Gallons per Minute)									
	50 GPM	100 GPM	500 GPM	1000 GPM	2000 GPM	3000 GPM	4000 GPM	5000 GPM	6000 GPM	7000 GPM
Zone IA	Sanitary setback distance									
Zone IB (3 Yr. TOT)	10,000'	10,000'	10,600'	11,200'	12,300'	13,400'	14,500'	15,600'	16,700'	17,700'
Zone II (6 Yr. TOT)	19,600'	19,700'	20,200'	20,900'	22,100'	23,300'	24,400'	25,500'	26,600'	27,700'
Zone III (10 Yr. TOT)	32,700'	32,800'	33,400'	34,000'	35,300'	36,500'	37,700'	38,800'	40,000'	41,100'

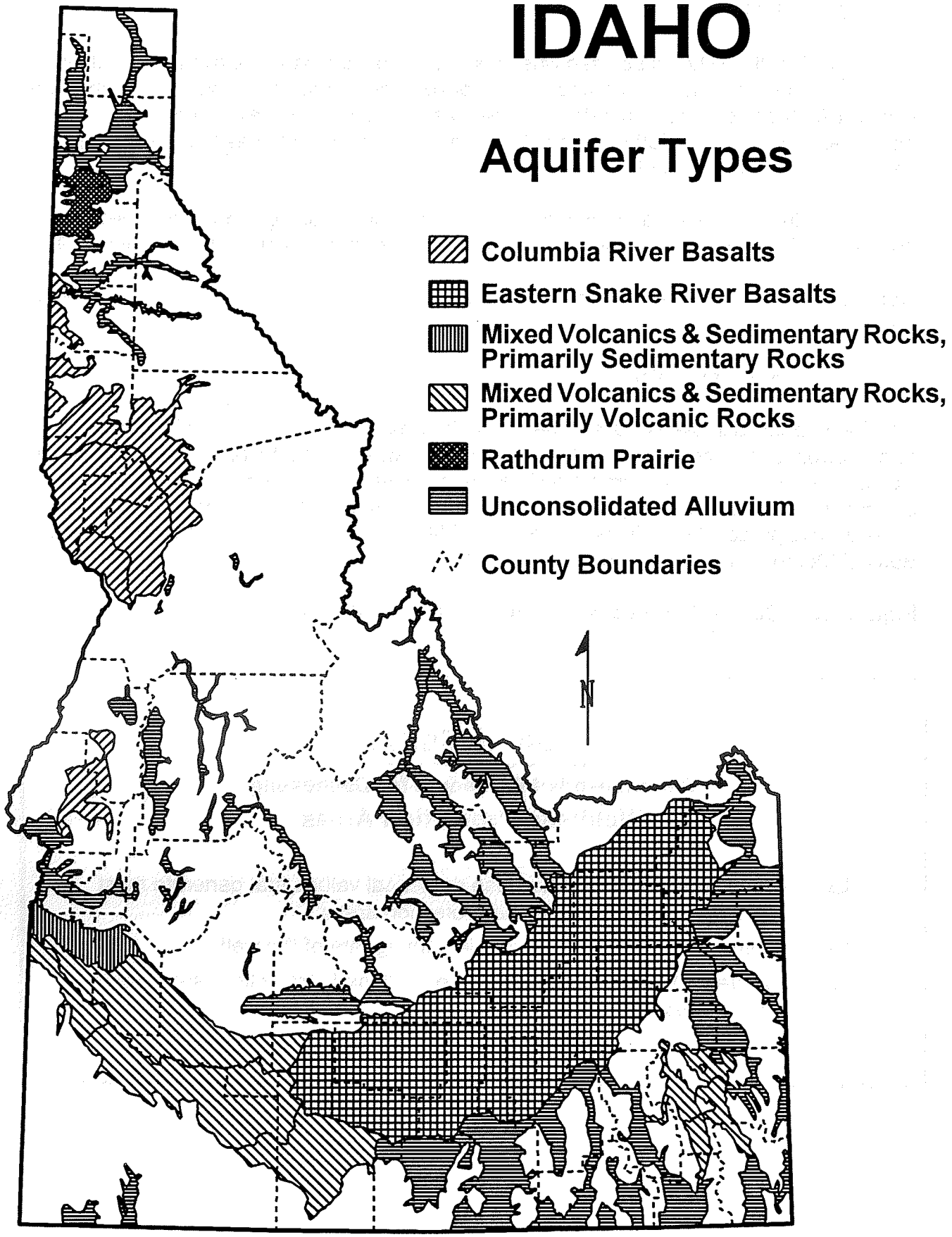
Table 4.8d

Mixed Volcanic and Sedimentary Rocks - Primarily Sedimentary Rocks										
Zone	**Peak Pumping Rate (Gallons per Minute)**									
	50 GPM	**100 GPM**	**500 GPM**	**1000 GPM**	**2000 GPM**	**3000 GPM**	**4000 GPM**	**5000 GPM**	**6000 GPM**	**7000 GPM**
Zone IA	Sanitary setback distance									
Zone IB (3 Yr. TOT)	200'	300'	500'	700'	1100'	1300'	1600'	1800'	2000'	2300'
Zone II (6 Yr. TOT)	300'	400'	800'	1100'	1500'	1800'	2100'	2400'	2600'	2900'
Zone III (10 Yr. TOT)	500'	600'	1000'	1400'	1900'	2300'	2700'	3000'	3300'	3600'

Table 4.8e

Mixed Volcanic and Sedimentary Rocks - Primarily Volcanic Rocks										
Zone	**Peak Pumping Rate (Gallons per Minute)**									
	50 GPM	**100 GPM**	**500 GPM**	**1000 GPM**	**2000 GPM**	**3000 GPM**	**4000 GPM**	**5000 GPM**	**6000 GPM**	**7000 GPM**
Zone IA	Sanitary setback distance									
Zone IB (3 Yr. TOT)	5000'	5000'	5200'	5400'	5700'	6000'	6400'	6700'	7000'	7200'
Zone II (6 Yr. TOT)	9800'	9800'	10,000'	10,200'	10,600'	11,000'	11,300'	11,600'	11,900'	12,300'
Zone III (10 Yr. TOT)	16,400'	16,400'	16,600'	16,800'	17,200'	17,600'	18,000'	18,300'	18,700'	19,000'

Figure 4.8 Map of Major Aquifers in Idaho



4.6.2 Basic II Method

The Basic II Method should be used when some site specific data are available, but when data, technical expertise, and/or funding are not sufficient to use the refined approach. The Basic II Method is more accurate than the Basic I Method, however, it is only a better estimate. The Basic II Method is a calculated fixed radius and uses the same equation used for the Basic I Method.

The procedure for delineating wellhead protection areas using the Basic II Method is outlined in Figure 4.9. The guidelines for the zone boundaries are listed in Table 4.9.

Communities that choose this option will need to contact IDEQ to have the calculation performed.

4.6.3 Rationale/Discussion

The basic approach takes advantage of existing data to provide an easily understood, easily applied, low cost wellhead protection area when limited site specific data exist. Communities that use this approach will be made aware of the enhanced benefits of using site specific data and more sophisticated methods. They will be encouraged to phase into the refined approach if initially using the Basic II Method, and will be encouraged to use the Basic II Method if initially using the Basic I Method.

Figure 4.9 Delineation Procedure for the Basic II Method

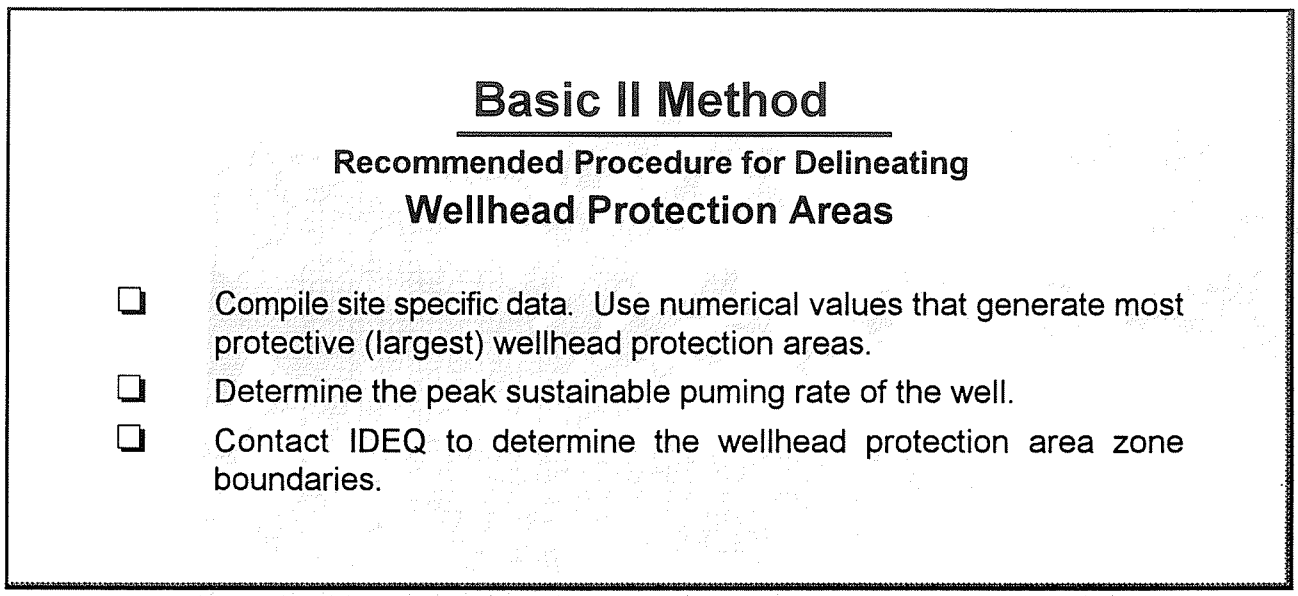


Table 4.9. Wellhead Protection Zones Using the Basic II Method

Zone	Zone Boundary	Method(s)	Comments
Zone IA	Sanitary setback distance established in the Idaho Rules for Public Drinking Water Systems.	Fixed radius	♦ Distance is consistent with the sanitary setback distance for wells and springs. ♦ Zone should be very strictly managed.
Zone IB	Minimum 3-year time of travel.	Calculated fixed radius using site specific data.	♦ The 3-year time of travel allows adequate time for a community to develop an interim response[1] to a release or indication of pending contamination at the wellhead. This time of travel is also consistent with a monitoring waiver program, and may assist with monitoring waiver approvals. ♦ Ground water velocity in this zone is influenced by the pumping well. ♦ Method is economical, easily understood, and easily quantified. ♦ Zone should be stringently managed.
Zone II	Minimum 6-year time of travel.	Calculated fixed radius using site specific data.	♦ The 6-year time of travel should allow adequate time for a community to develop a long term solution[2] to a release or indication of pending contamination at the wellhead. This time of travel is also consistent with a monitoring waiver program, and may assist with monitoring waiver approvals. ♦ Ground water velocity in this zone is likely to be dominated by the regional hydraulic gradient. ♦ Method is economical, easily understood, easily quantified, and useful for phasing. ♦ Zone should be managed appropriately.
Zone III	Minimum 10-year time of travel.[3]	Calculated fixed radius using site specific data.	♦ Zone which may include a portion of the recharge area to the aquifer. ♦ Ground water velocity in this zone is likely to be dominated by the regional hydraulic gradient. ♦ Method is economical, easily understood, easily quantified, and useful for phasing. ♦ Zone should, at a minimum, be managed with public education efforts.

1 Examples: mitigating a contamination problem and providing interim alternative water supplies.

2 Examples: remediating a contamination problem and finding a long term source of drinking water.

3 In some cases, this area may need evaluation to ensure that it is within the known area of the aquifer.

4.7 REFINED APPROACH

There are two methods that are categorized under the refined approach: the Refined Method and the Refined Exception Method. For those communities that choose the refined approach, the method that will most commonly be used is the Refined Method. The Refined Exception Method is to be used only in special cases when the standard wellhead protection area is so large as to be unmanageable.

Water purveyors and/or local governments are responsible for the refined delineation. This delineation should be in cooperation with the community planning team and, if requested, with assistance from IDEQ. This partnership is imperative for the success of the local plan, especially if the water system is not operated by the local government.

Both methods of this approach require the use of site specific data and more sophisticated methods, such as analytical, semi-analytical and numerical modeling, and hydrogeologic mapping. These methods require the assistance and judgement of technical professionals. Obviously, these areas are more accurately defined than the wellhead protection areas using the basic approach. However, the refined approach only offers a better estimation.

Site specific data are data that are unique to the well(s) in the area of interest and are obtained by hydrogeologic investigations, such as aquifer tests, dye tracer tests, and stratigraphic studies. The field method or method of data evaluation to define the numerical value of these data should be determined by technical professionals. However, if there are uncertainties or ranges of values for these parameters, then the value used in the delineation analysis should be the one that yields the most protective (largest) wellhead protection area. The value for well discharge should be the peak sustainable pumping rate of the well.

The type of data needed for the refined approach include:

- transmissivity;
- boundary conditions;
- effective porosity;
- lithology;
- regional hydraulic gradient;
- storativity;
- hydraulic conductivity;
- degree of confinement;
- aquifer saturated thickness; and
- recharge area.

A technical guidance document developed by the EPA, "Model Assessment for Delineating Wellhead Protection Areas," EPA 440/6-88-002, provides possible ground water flow and contaminant transport models that might be used. The EPA has also developed a modular, semi-analytical ground water flow model, WHPA Code 2.2, which is designed specifically to delineate capture zones. This model is applicable to homogeneous aquifers that exhibit two dimensional, steady state ground water flow.

4.7.1 Refined Method Zones

Wellhead protection areas using the Refined Method are zoned using the guidelines shown in Table 4.10. It is anticipated that most of the larger communities will use this method as more accurate wellhead protection areas will be desired to protect the ground water resource.

The delineation analysis should be the one that yields the most protective (largest) wellhead protection area. The value for well discharge should be the peak sustainable pumping rate of the well.

Table 4.10. Wellhead Protection Zones Using the Refined Method

Zone	Zone Boundary	Method(s)	Comments
Zone IA	Sanitary setback distance established in the Idaho Rules for Public Drinking Water Systems.	Fixed radius	♦ Distance is consistent with the sanitary setback distance for wells and springs. ♦ Zone should be very strictly managed.
Zone IB	Minimum 3-year time of travel.	Hydrogeologic mapping, semi-analytical, analytical, or numerical modelling using site specific data.	♦ The 3-year time of travel allows adequate time for a community to develop an interim response[1] to a release or indication of pending contamination at the wellhead. This time of travel is also consistent with a monitoring waiver program, and may assist with monitoring waiver approvals. ♦ Ground water velocity in this zone is influenced by the pumping well. ♦ Methods should incorporate actual conditions and can be used to refine the basic approach. ♦ Zone should be stringently managed.
Zone II	Minimum 6-year time of travel.	Hydrogeologic mapping, semi-analytical, analytical, or numerical modelling using site specific data.	♦ The 6-year time of travel should allow adequate time for a community to develop a long term solution[2] to a release or indication of pending contamination at the wellhead. This time of travel is also consistent with a monitoring waiver program, and may assist with monitoring waiver approvals. ♦ Ground water velocity in this zone is likely to be dominated by the regional hydraulic gradient. ♦ Methods should incorporate actual conditions and can be used to refine the basic approach. ♦ Zone should be managed appropriately.
Zone III	Minimum 10-year time of travel.[3]	Hydrogeologic mapping, semi-analytical, analytical, or numerical modelling using site specific data.	♦ Zone which may include a portion of the recharge area to the aquifer. ♦ Ground water velocity in this zone is likely to be dominated by the regional hydraulic gradient. ♦ Methods should incorporate actual conditions and can be used to refine the basic approach. ♦ Zone should, at a minimum, be managed with public education efforts.
Recharge Areas and Flow Boundaries	Recharge areas and flow boundaries	Hydrogeologic mapping.	♦ Concern is primarily for vertical recharge, but should also include horizontal recharge. ♦ Method should incorporate actual conditions. ♦ Zone should be managed appropriately.

[1] Examples: mitigating a contamination problem and providing interim alternative water supplies.

[2] Examples: remediating a contamination problem and finding a long term source of drinking water.

[3] In some cases, this area may need evaluation to ensure that it is within the known area of the aquifer.

4.7.2 Refined Exception Method Zones

The Refined Exception Method is a special case of the refined approach. This method should only be used if it can be demonstrated that the combined zones (Zone IB, II, III) of the standard Refined Method are so large as to be unmanageable and if the community can demonstrate that they can effectively manage the potential sources of contamination in a smaller wellhead protection area. Figure 4.10 shows the assessment process to determine the appropriate use of the Refined Exception Method.

The zone boundaries for this method are listed in Table 4.11.

Figure 4.10 Assessment for Appropriate Use of the Refined Exception Method

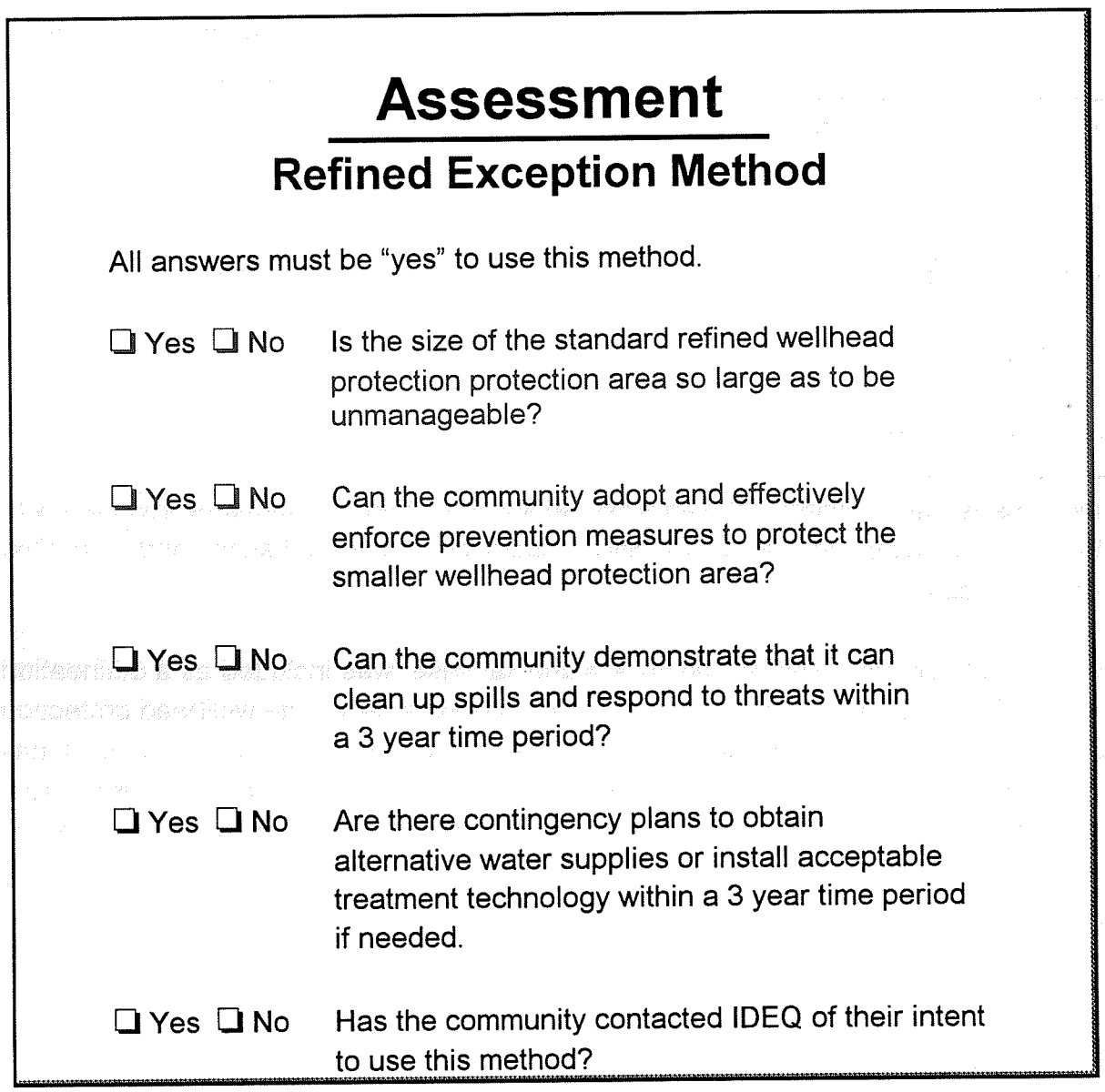


Table 4.11. Wellhead Protection Zones Using the Refined Exception Method

Zone	Zone Boundary	Method(s)	Comments
Zone IA	Sanitary setback distance established in the Idaho Rules for Public Drinking Water Systems.	Fixed radius	♦ Distance is consistent with the sanitary setback distance for wells and springs.
Zone IB	Minimum 3-year time of travel.	Hydrogeologic mapping, semi-analytical, analytical, or numerical modeling using site specific data.	♦ The 3-year time of travel allows adequate time for a community to develop an interim response[1] to a release or indication of pending contamination at the wellhead. This time of travel is also consistent with a monitoring waiver program, and may assist with monitoring waiver approvals. ♦ Ground water velocity in this zone is influenced by the pumping well. ♦ Methods should incorporate actual conditions and can be used to refine the basic approach.
Zone II	Recharge areas and flow boundaries.	Hydrogeologic mapping.	♦ Concern is primarily for vertical recharge but should also include horizontal recharge. ♦ Method should incorporate actual conditions.

[1]Examples: mitigating a contamination problem and providing interim alternative water supplies.

4.7.3 Rationale/Discussion

The refined approach provides an alternative for those communities who desire more accurate delineations of their wellhead protection areas such that more specific and comprehensive management of the area can be applied. Also, communities that start with the basic approach may phase into the refined approach as the need arises and resources become available.

The Refined Exception Method, which is a special case, was included as a delineation option because there may be some communities with extremely large wellhead protection areas, but have very strong management and response programs. In these cases, it may be better to manage effectively a smaller area than to poorly manage a large area. Communities that intend to use the Refined Exception Method will need to meet certain conditions which are listed in Figure 4.10. One of the most important conditions established is the ability of the community to manage the smaller wellhead protection area more stringently.

4.8 SPECIAL CASES OF WELLHEAD PROTECTION

Special cases of wellhead protection will be approved for certification by IDEQ and if needed, the Technical Task Force will be consulted. The appropriate conditions to use this approach are outlined in Figure 4.11.

Special cases of wellhead protection should be considered for reasons such as attributes of an aquifer or to increase the effectiveness of management strategies. In some cases, such as the Rathdrum Prairie Aquifer, the ground water velocity within the aquifer is very high such that the ground water would best be protected using the aquifer protection approach. In other cases, ground water protection may simply be more effective if two or more political entities cooperatively managed an aquifer or a portion of an aquifer.

Figure 4.11. Assessment for Appropriate Use of the Special Case Approach

Assessment

Special Cases (Aquifer Protection)

All answers must be "yes" to use this method.

❑ Yes ❑ No Does aquifer protection more closely meet the goals of the community(ies) for drinking water and ground water protection?

❑ Yes ❑ No Has the aquifer been sufficiently studied to establish hydrologic boundaries?

❑ Yes ❑ No Are there coordination mechanisms in place to assist the community(ies) in managing the larger protection area?

❑ Yes ❑ No Have the coordinating entities contacted IDEQ of their intent to use this method?

4.8.1 A Special Case Example: Rathdrum Prairie Aquifer

The Rathdrum Prairie Aquifer, located in northern Idaho, was deposited during flooding from glacial Lake Missoula during the Great Ice Age, approximately 14,000 years ago. It is composed of sand and gravel, fine to coarse, poorly to moderately sorted, with scattered

cobbles and boulders. The calculated values of ground water velocity in these sediments are high and vary between 41.1 - 90.5 feet/day. (U.S. Geological Survey, 1978).

The aquifer is cooperatively managed by the Coeur d'Alene Regional Office of IDEQ, the Panhandle District Health Department, Kootenai County, communities on the aquifer, and the State of Washington. The aquifer management effort has been ongoing since the late 1970s.

Wellhead protection areas on the Rathdrum Prairie Aquifer were modeled by the Coeur d'Alene Regional Office of IDEQ. It was found that the individual wellhead protection areas were very narrow because of the high transmissivities and extended from the wellhead to the closest major recharge area. The Technical Task Force concurred with the managing entities that aquifer management was the most appropriate method and has developed special wellhead protection delineation guidelines shown in Table 4.12. The development of different delineation guidelines for the Rathdrum Prairie Aquifer is not directly related to its status as a Sole Source Aquifer or additional protective criteria existing within Idaho rules.

Table 4.12. Zones for the Rathdrum Prairie Aquifer

Zone	Zone Boundary	Method(s)	Comments
Zone I	Sanitary setback distance established in the Idaho Rules for Public Drinking Water Systems. Minimum distance of 300 feet for wetted recharge zones[1].	Fixed radius	♦ Distance is consistent with the sanitary setback distance for wells and springs. ♦ The 300 foot setback distance is consistent with the setback distance requirement from surface water in the "Individual and Subsurface Sewage Disposal Regulations." ♦ Method is economical, easily understood, and easily quantified.
Zone II	Aquifer boundary as established by EPA, February 1978.	Hydrogeologic mapping.	
Zone III	Critical aquifer recharge areas[2].	Hydrogeologic mapping.	

1 "Wetted recharge zones" refer to the terminal ends of streams that infiltrate high volumes of water directly to the Rathdrum Prairie Aquifer. These areas directly link surface water with the aquifer and exist as outfalls for Hauser Creek, Rathdrum Creek, Spirit Lake, Hayden Lake, and several other streams (Division of Environmental Quality, 1991). They are very vulnerable to contamination from surface activities because they exhibit saturated flow conditions during certain times of the year (Sutherland, 1992).

2 "Critical aquifer recharge areas" refer to recharge areas outside the formal aquifer boundaries (Division of Environmental Quality, 1991). The definition of a critical aquifer recharge area includes:

- surface watersheds that drain directly into the Rathdrum Prairie Aquifer without flowing through a lake;
- lake watersheds where the lake discharge is exclusively to the Rathdrum Prairie Aquifer, including Spirit Lake, Twin Lakes, Hauser Lake, and Hayden Lake; and
- aquifers that discharge directly into the main Rathdrum Prairie Aquifer. These areas have been limited to outlets that discharge directly to the aquifer and have no other water outlet. There are 19 areas identified as critical aquifer recharge areas.

4.8.2 Rationale/Discussion

This option was developed because there may be situations in which aquifer protection is more relevant to achieving the goals of the wellhead protection program than managing individual wellhead protection areas. A coordinated management effort will be needed to effectively manage an aquifer or portion of an aquifer.

4.9 WELLHEAD PROTECTION AREA DELINEATION AND PUMPING RATE CHANGE

The delineation of a wellhead protection area should be reevaluated when there is a change, either an increase or decrease, in pumping rate or water right of the well.

4.9.1 Rationale/Discussion

Defining wellhead protection areas will take into consideration the peak sustainable pumping rate in gallons per minute of the well. Often times, however, the pumping rate or water right of a well will be changed to meet a different water demand. When there is a change of the pumping rate or water right, the delineation of the wellhead protection area should be reevaluated because the well pump rate may affect the size of the wellhead protection area.

4.10 WELLHEAD PROTECTION AREAS FOR WELLFIELDS

If the area of contribution of wells overlap and the basic approach (Basic I or Basic II Method) is used, then the wellhead protection area should be defined by combining the wellhead protection areas of those wells (Figure 4.13). The combined wellhead protection areas are called a wellfield protection area. If the refined delineation approach is used, the wellfield protection area can be defined by using a computer modeling program.

4.10.1 Rationale/Discussion

A wellfield protection area will be easier to manage than individual overlapping wellhead protection areas.

4.11 WELLHEAD PROTECTION AREA BOUNDARY ADOPTION

Wellhead protection area boundaries should be adopted by the appropriate entity(ies).

If a community determines that it will need to manage a multi-jurisdictional wellhead protection area(s), the local wellhead protection plan should include the mechanism of coordination or criteria of the pending mechanism of coordination in an appendix to the plan (Reference, Community Planning Teams in Chapter 3).

4.11.1 Rationale/Discussion

Many wellhead protection areas in Idaho are anticipated to include land within the jurisdiction of multiple governmental entities. All governmental entities will need to work cooperatively to effectively manage these areas.

Mechanisms to manage multijurisdictional wellhead protection areas may include:

- letter of agreements and
- memorandums of understanding.

Also, if there is a legal agreement between the entities, ordinances and local comprehensive plans can then be used to manage these areas.

4.12 WELLHEAD PROTECTION AREA INFORMATION TO BE SUBMITTED TO THE STATE

Information on wellhead protection area boundaries should be submitted to IDEQ on a detailed map. This map should show the sources of contamination within the wellhead protection area boundaries. The recommended map scales are:

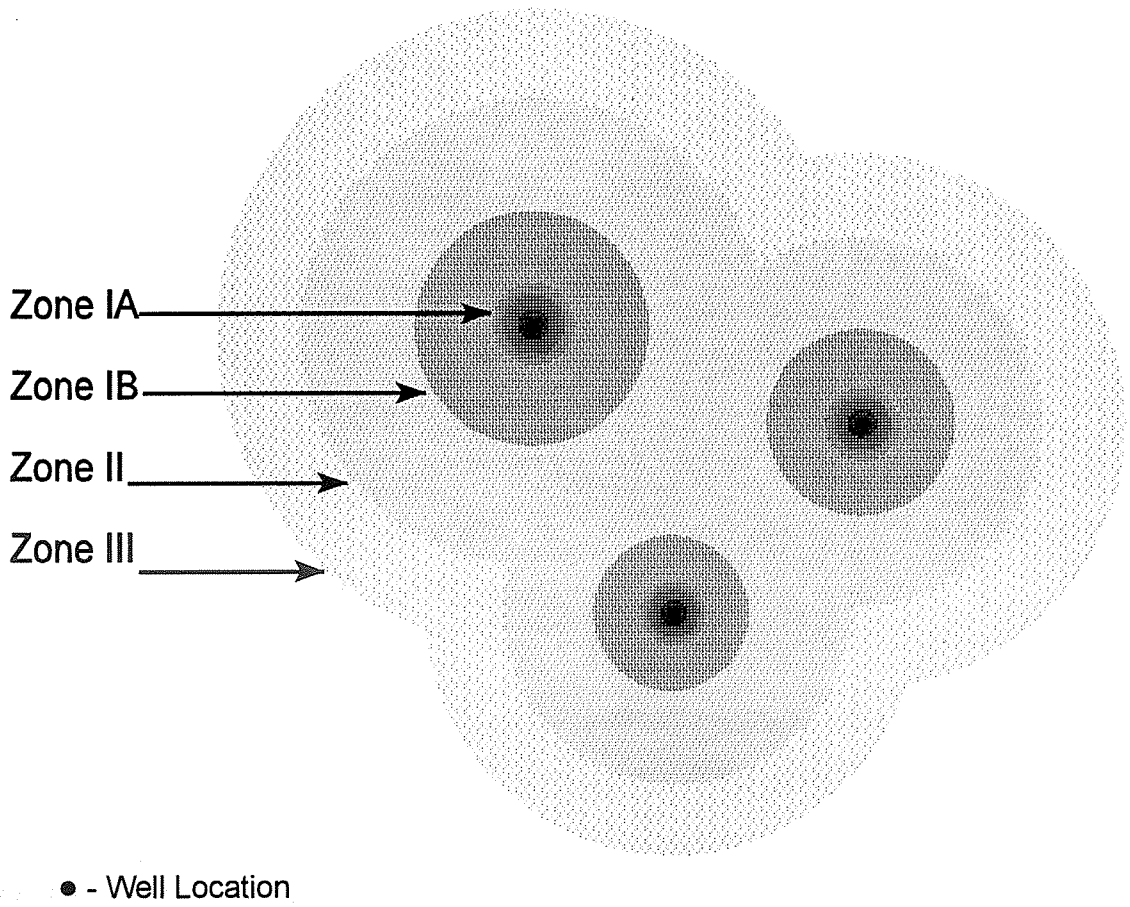
Zone IA:	Scale of 1:300
Zone IB:	Scale of 1:300
Zone II:	Scale of 1:24,000 (7.5 minute quadrangle)
Zone III:	Scale of 1:24,000 unless the zone is very distant, then use 1:100,000

The IDEQ may help develop these maps if requested.

4.12.1 Rationale/Discussion

The Technical Task Force recommended that wellhead protection boundary information be submitted at these map scales because the scales are appropriate for the sizes of the individual zones. Also, maps at these scales are commonly used and readily available.

Figure 4.12 Wellfield Concept Using the Basic I Method



Chapter Five

Inventory of Potential Sources of Contamination

5.0 INVENTORY OF POTENTIAL SOURCES OF CONTAMINATION

Potential sources of contamination within wellhead or wellfield areas need to be inventoried, then managed, to prevent the contamination of ground water supplying the well(s) or spring(s). This chapter addresses the inventory aspect of wellhead protection.

The EPA has developed a technical assistance document called "Guide for Conducting Contaminant Source Inventories for Public Drinking Water Supplies" (1991). This document discusses the design, structure, and function of contaminant source inventories and can assist communities in addressing this component of the Wellhead Protection Program. It also offers a suggested inventory form and includes copies of forms that have been used by other states.

5.1 POTENTIAL SOURCES OF CONTAMINATION

The Idaho Wellhead Protection Work Group developed categories of potential sources of contamination based on a list developed by the EPA. In addition, these categories were supplemented with examples and related activities (Table 5.1). These categories were not assigned a relative risk. Instead, local governments should work with the various entities, discussed under "Responsibilities of the Water Purveyor and Local Government", in this chapter, to prioritize their sources. The potential sources of contamination list will be updated, as needed, by IDEQ.

Unregulated sources of contamination are included as supplemental information under the Examples/Related Activity heading. Additional information on unregulated sources of contamination can be found in the EPA Technical Assistance Document, "A Review of Sources of Ground Water Contamination from Light Industry."

5.2 INVENTORY RESPONSIBILITIES AND PROCEDURES

5.2.1 Responsibilities of the Water Purveyor and Local Government

Once wellhead protection areas have been delineated, the water purveyor and the local government need to compile and maintain an inventory of potential sources of contamination that are located in these areas. The source inventory information should be kept with the water purveyor and/or the local government and should be submitted to the entities involved with local emergency response activities.

Although the inventory of potential sources of contamination should include all sources (see Table 5.1), plans that are submitted to IDEQ for certification will at a minimum need to include an inventory of those sources that are primarily managed by state or federal agencies. Examples of these types of sources include underground storage tanks with greater than 1,100 gallon capacity, landfills, and land application sites. This information will assist IDEQ in coordinating protection efforts with other agencies or programs involved with ground water quality. Information on state or federally managed sources of ground water contamination and the associated administering agency(ies) is given in Table E-1 in Appendix E.

However, activities that are not regulated by the state or federal governments can cause an impact on ground water quality. Therefore, local governments and water purveyors are encouraged to compile an inventory that is as detailed as possible.

Table 5.1. Categories of Potential Sources of Contamination

CATEGORY I Sources designed to discharge substances	
Source	**Examples/Related Activity**
Injection Wells	♦ Class V injection wells (covered under state regulations); examples include: ♦ Agricultural return water disposal ♦ Urban runoff disposal ♦ Heat pump return wells ♦ Mining waste disposal ♦ Artificial recharge wells ♦ Municipal disposal wells (prohibited by state rules; include certain Class I injection wells.) ♦ Wells used for disposal of fluids associated with gas or oil production and wells which inject fluids for the extraction of minerals (prohibited by state rules; include Class II & III injection wells) ♦ Wells used to inject hazardous or radioactive wastes (prohibited by federal and/or state rules; include Class IV and certain Class I injection wells)
Land Application	♦ Municipal or industrial wastewater ♦ Municipal or industrial sludge or septage
Non-Waste	♦ Artificial recharge ♦ Enhanced steam recovery ♦ Geothermal discharge ♦ Ground water heat pump discharge
Subsurface percolation	♦ Cesspools ♦ Septic tanks ♦ Storm water drain fields ♦ Injection wells

Table 5.1 - Continued

CATEGORY II Sources designed to store, treat, and/or dispose of substances; discharge through unplanned release	
Source	**Examples/Related Activity**
Above ground storage tanks	♦ Chemical storage ♦ Fertilizer storage ♦ Fuel storage for homes and business ♦ Lubricant storage ♦ Pesticide storage ♦ Solvent storage ♦ Tank farms ♦ Transportation maintenance shops ♦ Waste or used material storage
Animal burial	♦ Animal burial
Containers of hazardous, non-hazardous, and non-waste materials	♦ Airports ♦ Appliance repair shops ♦ Automotive repair and body shops ♦ Beauty shops ♦ Boat builders and refinishers ♦ Chemical manufacturers ♦ Dry cleaners ♦ Electroplaters and metal fabricators ♦ Engine repair shops ♦ Fertilizer storage ♦ Furniture strippers and refinishers ♦ Health clinics ♦ Laboratories ♦ Leather manufacturers ♦ Machine shops ♦ Metal and drum cleaning or reconditioning ♦ Mortuaries ♦ Ore processors ♦ Paint shops ♦ Pesticide storage ♦ Photographic processors ♦ Plant nurseries ♦ Printers, blueprint shops ♦ Prisons ♦ Railroad yards ♦ Refrigeration shops ♦ Repair shops ♦ Rust proofing shops ♦ Textile and apparel producers ♦ Transportation maintenance shops ♦ Wood treatment facilities
Detonation sites	♦ Military facilities ♦ Ordnance disposal
Graveyards	♦ Human burial (embalming chemicals)

Table 5.1 - Continued

CATEGORY II Sources designed to store, treat, and/or dispose of substances; discharge through unplanned release	
Source	**Examples/Related Activity**
Landfills	♦ Industrial hazardous waste ♦ Industrial non-hazardous waste ♦ Municipal sanitary ♦ Non-municipal solid waste
Materials stockpiles	♦ Animal feed piles ♦ Battery storage ♦ Coal storage ♦ Fertilizer piles ♦ Junkyards ♦ Road salt storage ♦ Scrap yards
Open dumps	♦ Abandoned dumps ♦ Illegal dumps
Open burning sites	♦ Trash burning areas ♦ Pesticide container disposal ♦ Firefighter training sites
Radioactive disposal sites	♦ Federal facilities ♦ Mining wastes ♦ Preprocessing sites
Residential disposal	♦ Trash burning residue ♦ Waste oil disposal
Surface impoundments	♦ Food processing ♦ Industrial processing ♦ Sewage lagoons
Underground storage tanks	♦ Chemical storage ♦ Fertilizer storage ♦ Fuel storage for home or business ♦ Lubricant storage ♦ Pesticide storage ♦ Retail fuel facilities ♦ Solvent storage ♦ Tank farms/bulk storage areas ♦ Transportation maintenance shops ♦ Waste or used material storage
Waste tailings	♦ Acid mine drainage ♦ Mine tailings
Waste piles	♦ Asphalt and construction debris ♦ Agricultural wastes ♦ Animal wastes ♦ Community compost piles ♦ Food processing wastes ♦ Wood wastes

Table 5.1 - Continued

CATEGORY III Sources designed to retain substances during transport or transmission	
Sources	**Examples/Related Activity**
Materials transport or transfer	♦ Transfer stations ♦ Vehicles carrying hazardous materials or waste
Pipelines	♦ Geothermal lines ♦ Petroleum lines ♦ Sewer lines ♦ Slurry lines

CATEGORY IV Sources discharging substances as a consequence of other planned activities	
Source	**Examples/Related Activity**
Animal feeding operations	♦ Animal clinics ♦ Aquaculture ♦ Dairies ♦ Feedlots ♦ Kennels ♦ Poultry farms ♦ Race tracks ♦ Zoos
De-icing salt applications	♦ Airports ♦ Transportation corridors
Irrigation practices	♦ Agricultural return water
Mining	♦ Mine site runoff ♦ Ore processing by cyanidation
Percolation of atmospheric pollutants	♦ Acid rain
Pesticide and fertilizer applications	♦ Agriculture lands ♦ Cemeteries ♦ Demossing of irrigation canals ♦ Golf courses ♦ Lawns ♦ Parks ♦ Transportation corridors
Urban runoff	♦ French drains ♦ Infiltration basins ♦ Storm wells

Table 5.1 - Continued

CATEGORY V Sources providing a conduit or inducing discharge through altered flow patterns	
Source	**Examples/Related Activity**
Construction excavation	♦ Construction excavation
Other non-waste wells or borings	♦ Exploration wells ♦ Monitoring wells ♦ Test holes (geotechnical borings, such as soil characterization tests)
Production wells	♦ Oil and gas wells ♦ Geothermal or heat recovery wells
Water supply wells	♦ Improperly abandoned wells ♦ Improperly constructed wells ♦ Improperly operating chemigation systems/activities ♦ Contaminated wells
Utility Corridors	♦ Buried water and sewer line ♦ Buried communication lines ♦ Buried power lines ♦ Buried gas lines

CATEGORY VI Naturally occurring sources whose discharge is created and/or exacerbated by human activity	
Source	**Examples/Related Activity**
Gravel mining operations	♦ Gravel pit and rock quarries
Ground water and surface water interactions	♦ Dams (cause unnatural movement of surface water into ground water) ♦ Irrigation canals and drains
High total dissolved solids or salt water intrusion	♦ Increased pumping of shallow ground water can cause an upward movement of higher mineral content ground water into the shallow aquifer
Natural leaching	♦ Increased application of water in excess of natural precipitation can cause leaching

The water purveyor and the local government need to prioritize the potential sources based on relative risk and can obtain assistance from the following entities:

- ♦ Federal Agencies
- ♦ Health Districts
- ♦ Idaho Division of Environmental Quality

- Idaho Department of Health and Welfare, Division of Health, Office of Environmental Health
- Idaho Department of Agriculture
- Idaho Department of Water Resources
- Local Emergency Response Committee
- State Emergency Response Commission

5.2.1.1 Rationale/Discussion

The water purveyor and/or the local government need to compile and maintain their own inventory to manage their wellhead protection area(s).

All of the source inventory information is not required to be submitted to IDEQ because it would present data management problems and would be a burden on water purveyors/local governments to continually send updates on all sources. At a minimum, however, local plans that are submitted for certification should include an inventory of sources that are primarily managed by the state or federal governments. The source inventories should be updated as discussed under "Frequency of Inventory" in this chapter.

The categories of potential sources of contamination (Table 5.1) were not ranked with relative levels of risk for two main reasons. First, several so called low risk potential sources of contamination, such as septic systems, could create a high risk, if present in sufficient numbers. Secondly, relative risk is site specific; therefore, prioritizing source risks should be performed at the local level. It will be emphasized, however, that prioritizing the potential sources of contamination based on relative risk will be necessary when developing management strategies.

5.2.2 Responsibilities of the Lead Agency

IDEQ will help develop forms that can be used to assist local governments in conducting the source inventory. Water purveyors and local governments are encouraged to use an inventory form. IDEQ may also assist with the inventory process where requested.

5.2.2.1 Rationale/Discussion

A source inventory form will assist water purveyors and local governments in collecting the necessary information. Also it may assist IDEQ in managing the data, or may be useful to the drinking water monitoring program.

5.2.3 Frequency of Inventory

It is anticipated that over time the land uses within an established wellhead protection area will change. Therefore, the Wellhead Protection Work Group recommends that the source inventory within wellhead protection areas be updated after the initial inventory, using the following time frames:

- inventory within Zones IA and IB should be updated on a regular basis.
- inventory within Zones II, III, and recharge areas should be updated at least every two years.

Communities with certified plans should submit updated information on federal or state managed sources to IDEQ every two years. This will assist the agency in maintaining coordination with other programs and agencies.

5.2.3.1 Rationale/Discussion

The source inventory in Zones IA and IB should be updated on a continuous basis because these are the most vulnerable zones around the wellhead. The inventory in Zones II, III, and the recharge area also needs to be updated, but since the zones are further from the wellhead, the update is not as critical as in the two closer zones.

Chapter Six

Management of Potential Sources of Contamination

6.0 MANAGEMENT OF POTENTIAL SOURCES OF CONTAMINATION

The management of potential sources of contamination within wellhead protection areas is the crux and perhaps the most challenging component of the Wellhead Protection Program. Levels of management will typically vary for each of the zones within a wellhead protection area. There are numerous tools, both regulatory and non-regulatory, that can be and have been used to successfully manage wellhead protection areas in the country.

6.1 WELLHEAD PROTECTION AREA MANAGEMENT POLICIES

6.1.1 Duties

Local governments have the authority to manage potential sources of contamination within wellhead protection areas in their jurisdiction. The authorities for local governments to accomplish this component of wellhead protection are discussed under "Program Roles and Responsibilities," Chapter 3.

6.1.2 Management of the Wellhead Protection Area

In general, there should be an appropriate level of management throughout wellhead protection areas, with progressively more stringent management of land use and waste discharge closer to the wellhead.

The general management strategy policies for each zone within wellhead protection areas are shown in Table 6.1.

Communities that choose to use the refined exception delineation will need to develop management strategies that are consistent with effectively managing the smaller wellhead protection area. The zones for this delineation approach are discussed in detail under "Wellhead Protection Area Delineation," Chapter 4.

6.1.2.1 Rationale/Discussion

The primary purpose of subdividing wellhead protection areas into zones is to allow for management flexibility. The zones closest to the wellhead should be managed more stringently than those zones further away.

Table 6.1. Management Policies for the Zones of a Wellhead Protection Area

Zone	Management Policy
Zone IA: Sanitary setback distance for public drinking water wells.	♦ Prohibit all potential sources of contamination.
Zone IB: Minimum 3 year Time of Travel boundary.	♦ Implement more stringent management than in Zones II, III, or recharge areas. Use an appropriate mix of regulatory management tools, such as restricting or prohibiting some activities, in addition to non-regulatory management tools which should include public education and information. ♦ Source monitoring[1] is highly recommended.
Zone II: Minimum 6 year Time of Travel boundary.	♦ Implement an appropriate level of management using a mix of regulatory management tools, such as design and operating standards for those activities otherwise restricted within Zone IB, and non-regulatory management tools which should include public education and information. ♦ Source monitoring[1] is highly recommended.
Zone III: Minimum 10 year Time of Travel boundary.	♦ At a minimum, implement public education and information efforts.
Known recharge areas and flow boundaries.	♦ Implement an appropriate level of management. ♦ Source monitoring[1] is highly recommended.

[1]Source monitoring involves a regular evaluation of ground water quality around a potential source of contamination.

The management policies for the different zones have been selected for the following reasons:

Zone IA: Prohibition of all potential sources of contamination within the setback area of a well is required by the Idaho Rules Governing Public Drinking Water Systems.

Zone IB: Implementation of more stringent management than Zones II and III and source monitoring are recommended for this zone, because it is the surface area that most likely overlies the cone of depression. The cone of depression has a steeper hydraulic gradient toward the wellhead than the regional hydraulic gradient. Because the gradient toward the wellhead is steeper, a contaminant in the ground water in this area travels more quickly toward the wellhead than a contaminant release in the ground water in an area dominated by the regional hydraulic gradient, as in Zone II (Figure 6.1).

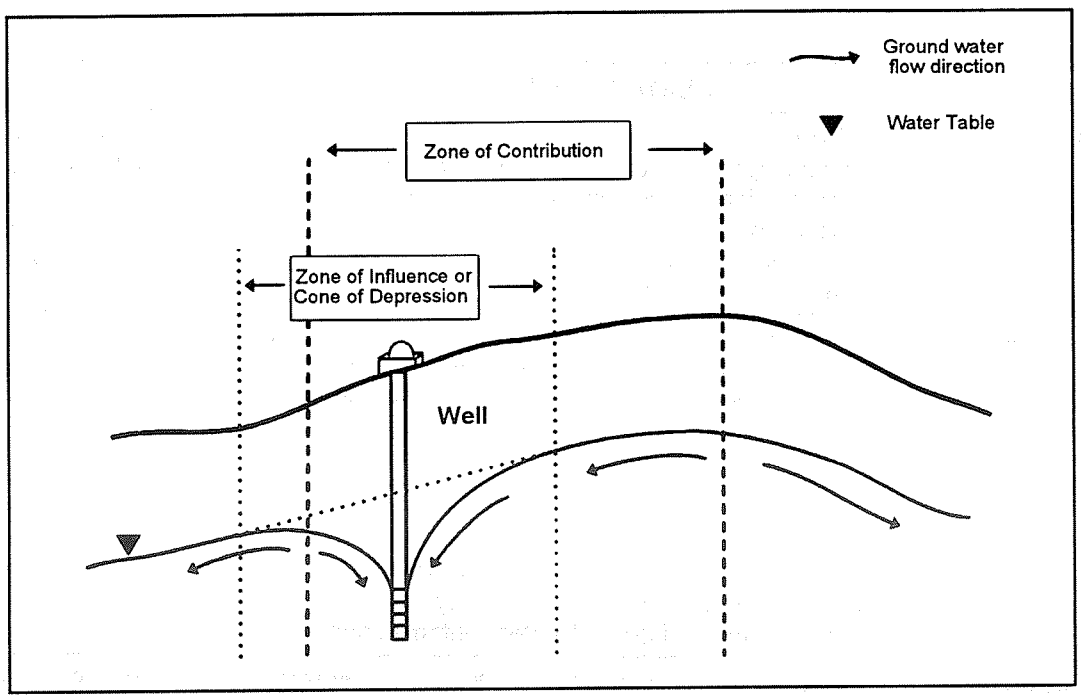
Zone II: This area needs to be managed by an appropriate level of stringency. It generally represents a portion of the area of contribution nearest the wellhead

that lies outside the cone of depression (Figure 6.1.) and most likely is dominated by the regional hydraulic gradient.

Zone III: At a minimum, this zone should be managed by public educational efforts as it also represents an area of contribution to the well.

Recharge Areas and Flow Boundaries:
Recharge areas should be appropriately managed to prevent ground water quality impacts. Ground water quality impacts from human activities in this zone can contribute to adverse water quality at the wellhead.

Figure 6.1 Conceptualized Ground Water Flow to a Pumping Well



6.2 MANAGEMENT TOOLS FOR WELLHEAD PROTECTION AREAS

There are both regulatory and non-regulatory tools that have been used to manage potential sources of contamination. These tools are listed and described within Table 6.2. Note that some management tools, such as ground water monitoring, can be applied in either a regulatory or non-regulatory framework. For further information, the reader can reference the EPA Technical Assistance Documents entitled "Tools for Local Governments" (1989) and "Local Financing for Wellhead Protection"(1989).

Examples of regulatory tools found within Table 6.2 include zoning ordinances, source prohibitions, design standards, and operating standards. Examples of non-regulatory tools

found within Table 6.2 include public education and information, hazardous waste collection, and pollution prevention. As noted, public education and information should be an important component of any wellhead protection program. Examples of public education and information activities include storm drain stenciling, providing workshops on waste stream minimization, notifying businesses and residents within wellhead protection areas, road signage, providing wastewater discharge workshops, implementing ground water contamination self assessment projects such as Home-A-Syst, initiating media interest in ground water protection, providing flyers and brochures on ground water protection issues, and incorporating ground water and wellhead protection education into the water/wastewater operator certification process.

Table 6.2 Management Tools for Wellhead Protection Areas

REGULATORY TOOLS	
Zoning Overlay	Overlay zones can be used in conjunction with conventional zoning and to create special districts to protect the wellhead protection area. Overlay zones are applied to areas singled out for special protection, such as the wellhead protection area itself, and add regulations to those controls already in place. This method helps address "grandfathered" potential contaminant sources in wellhead protection areas.
Zoning Ordinances	Zoning ordinances typically are comprehensive land-use requirements designed to direct the development of an area. Many local governments have used zoning to restrict or regulate certain land uses, which have the potential to contaminate ground water within wellhead protection areas.
Subdivision Ordinances	Subdivision ordinances are applied to land divided into two or more subunits for sale or development. Local governments use this tool to protect wellhead protection areas in which ongoing development is causing contamination. An example of a subdivision ordinance would be to require a minimum lot size for single family homes using septic systems so as to limit septic system density and subsequent ground water contamination.
Potential Source Prohibitions or Restrictions	Source prohibitions or restrictions are regulations that prohibit or place restrictions on the use of certain chemicals that pose a high risk to ground water contamination such as Atrazine or trichloroethene; or prohibit or place restrictions on the placement of some high-risk potential contaminant sources such as underground storage tanks, underground injection wells, lagoons, feedlots, and/or landfills.
Building Codes	Local building codes offer protection through special standards applicable to facilities which are remodeled or constructed in the wellhead protection area. Building codes can require low flow fixtures, backflow preventers and other design features to conserve and protect ground water.
Design Standards	Design standards typically are regulations that apply to the design and construction of buildings or structures. This tool can be used to ensure that new buildings or structures placed within a wellhead protection area are designed so as not to pose a threat to the water supply, such as requiring an impermeable liner on a settling pond.

Operating Standards	Operating standards are regulations that apply to ongoing land-use activities to promote safety or environmental protection. Such standards can minimize the threat to the wellhead protection area from ongoing activities such as the storage and use of hazardous substances through requirements such as secondary containment and spill response capabilities, or requiring that septic systems be properly maintained.
Site Plan Review	Site plan reviews are regulations requiring developers to submit for approval plans for development occurring within a given area. This tool ensures compliance with regulations or other requirements made within a wellhead protection area.
Bonding	Facilities may be required to post a bond prior to operation in a wellhead protection area. Bond can cover costs associated with spill response or remediation efforts.
Performance Standards	Performance standards are used to regulate development within wellhead protection areas by enforcing predetermined standards for water quality. They may be applied at a predetermined ground water monitoring compliance point, at the point of injection of stormwater runoff, or through the use of contaminant source modeling. One example is the requirement that the amount of stormwater runoff be the same before and after construction when developing or improving a site.
Special Permitting	Special permits are used to set conditions for certain uses and activities that pose a high risk to ground water contamination within wellhead protection areas if left unregulated. One example is to require that new feedlots within some of the wellhead protection area zones be required to have a city or county permit that may require ground water quality monitoring and/or the use of certain ground water protection management practices.
Transport Prohibitions	The transport of chemical compounds which pose a high risk to ground water quality if spilled can be restricted within a wellhead protection area by requiring alternative transportation routes.
NON-REGULATORY TOOLS	
Public Education and Information	Public education and information should be an important component of any wellhead protection program. Public education often consists of brochures, pamphlets, or seminars designed to present wellhead area problems and protection efforts. This tool promotes the use of voluntary protection efforts and builds public support for a community protection program.
Water Conservation Program	Implementing water conservation measures can significantly benefit wellhead protection efforts by reducing pumping rates. Lower pumping rates mean reduced flow rates and less risk of moving any contamination toward the wellhead. Conserving water may also help reduce the need for additional water sources in the near future. Water conservation can be accomplished through steps such as promoting the use of native vegetation, improved irrigation methods such as drip irrigation, and through public education.
Hazardous Waste Collection	Establishing a permanent location or holding one-day events to collect hazardous wastes from community residents (both small businesses and households) is a very effective way to reduce risks posed by storing hazardous wastes within the wellhead protection area. This would reduce the risk of improper disposal into septic systems not designed to handle such wastes or from improper disposal to the ground, and may also help protect a community's wastewater treatment plant from harmful chemicals.

Pollution Prevention	A pollution prevention program can include reducing the amount of chemical wastes or reducing the usage of certain chemicals by replacing them with chemicals that are less threatening to ground water quality. Pollution prevention is often accomplished through education and information, such as through the distribution of pollution prevention booklets specific to a type of source such as an automobile repair shop.
Purchase of Development Rights or Property	The purchase of property or development rights is a tool used by some localities to ensure complete control of land uses in or surrounding a wellhead protection area. This tool may be preferable if regulatory restrictions on land use are not politically feasible and the land purchase is affordable.
Spill Response Planning	Local governments can develop their own emergency spill response programs to minimize potential impacts of spills to ground water quality.
TOOLS THAT CAN BE REGULATORY OR NON-REGULATORY	
Best Management Practices (BMPS)	BMPS are practices or combination of practices which ultimately prevent or reduce contamination to ground water. Although often associated with agricultural activities, BMPS can apply to any activity that has the potential to impact ground water or surface water. BMPS can be encouraged through voluntary methods or can be required through regulations which may further define what a BMP is and how it is to be used.
Ground Water Monitoring	Ground water monitoring includes selecting appropriate sampling sites upgradient of the well and developing an ongoing water quality monitoring program. Monitoring can also be a regulatory requirement for high risk contaminant sources within a wellhead protection area.
Training and Demonstrations	These programs can complement many of the regulatory or non-regulatory tools. Examples include training of local emergency response teams or demonstration of agricultural BMPS.
Inspection Programs	Inspection of facilities and other contaminant sources can be developed as a voluntary program or through regulatory requirements. Voluntary inspection of businesses for pollution prevention and contaminant control ideas and recommendations is one example of a non-regulatory approach.

6.3 WELLHEAD PROTECTION AREA MANAGEMENT: AN EXAMPLE

To illustrate the zone management concepts and the application of various management tools to a potential source of contamination, the management strategies used by two fictitious communities are compared in Table 6.3. The example uses underground storage tanks as the potential source of contamination.

Some of the possible management strategies and tools specifically adapted to underground storage tanks include:

- implementation of new construction standards;
- installation of release detection and overflow prevention devices;
- bond or insure to cover costs associated with spill response or remediation;
- increased inspections/tank tightness testing;
- improved inventory control methods;

- corrosion protection of tank systems;
- installation of source monitoring;
- prohibition of the source; and
- public education and information pertaining to ground water quality risks and historical problems associated with leaking underground storage tanks.

Table 6.3 Examples of Zone Management Concepts

Zone	Community A Refined Approach	Community B Basic Approach
Zone IA	Prohibition of all underground storage tanks.	Prohibition of all underground storage tanks.
Zone IB	Implementation of new construction standards. Installation of release detection and overflow prevention devices. Improved inventory control methods. Public education and information.	Installation of release detection and overflow prevention devices. Increased inspection and tank tightness testing. Improved inventory control methods. Public education and information.
Zone II	Increased inspection and tank tightness testing. Improved inventory control methods. Public education and information.	Increased inspection and tank tightness testing. Improved inventory control methods. Public education and information.
Zone III	Increased inspection and tank tightness testing. Public education and information.	Public education and information.
Recharge Areas	Installation of source monitoring. Increased inspection and tank tightness testing. Improved inventory control methods. Public education and information.	

6.4 MULTI-JURISDICTION WELLHEAD PROTECTION AREAS

Ground water flow, thus wellhead protection areas, do not abide by political boundaries and therefore will not always be within one political jurisdiction. The State of Idaho anticipates that not only will wellhead protection areas cross city and county boundaries, but also will cross tribal and state boundaries.

In these situations, governmental entities will need to work cooperatively and can coordinate their efforts through a community planning team as discussed in Chapter 3 under "Community Planning Teams". Coordination mechanisms may also include letters

of agreement, memorandums of understanding, ordinances, comprehensive plans, and advisory groups.

6.5 WELLHEAD PROTECTION PROJECTS

There are several local wellhead protection projects in Idaho which are in various phases of development.

6.5.1 Rural Communities

The Idaho Rural Water Association has been offering technical assistance to rural communities that are interested in implementing wellhead protection. As of December 1994, 37 rural communities had accepted this offer. Some of these communities are now examining wellhead protection ordinances from other towns and cities in the nation and are deciding whether they can use these ordinances as they are or if they will need modification. Several of these communities have assisted in the development of the Idaho Wellhead Protection Plan.

A joint wellhead protection project for two neighboring communities, Newport, Washington and Oldtown, Idaho (West Bonner Water District) has formally been in progress since 1992. The project has been funded through the Washington Centennial Clean Water Funds and through a contract with IDEQ. These communities are developing a wellhead protection plan for their springs and wells.

6.5.2 Urban Communities

In fall of 1991, the City of Boise was awarded a wellhead protection demonstration grant from the EPA. Boise has been working on several aspects of a local wellhead protection program, such as education, source inventory, source management, coordinating wellhead protection into existing city programs, and supporting a study to compare the basic wellhead protection area with a computer modeled refined protection area. In addition, the City of Boise has very actively participated in the development of the Idaho Wellhead Protection Plan.

The City of Pocatello was awarded a wellhead protection demonstration grant from the EPA in 1992. Pocatello is working in cooperation with the Idaho Geological Survey to characterize the aquifer in greater detail to delineate refined wellhead protection areas. In addition, they will inventory past, present, and potential sources of contamination and will evaluate the findings to develop appropriate management tools. Representatives

from Pocatello have also participated in the development of the Idaho Wellhead Protection Plan.

6.5.3 Communities Involved with Aquifer Protection

In Northern Idaho, several entities have been implementing protective measures over the Rathdrum Prairie Aquifer primarily through grants from the EPA. These entities include IDEQ and the Panhandle District Health Department, in cooperation with Kootenai County and cities over the aquifer. The federal funds are shared with the State of Washington.

Kootenai County is currently developing, with financial assistance from IDEQ and the Panhandle District Health Department, sections of a comprehensive plan that target the protection of both the aquifer and its critical recharge areas. Subsequent land use ordinances to protect the aquifer are anticipated.

The entities involved in this aquifer/wellhead protection program have also worked together to implement local regulatory protection measures addressing sources such as sewage management and critical materials storage. Public education is an important component of the program and they have produced newsletters, worked with local community groups on aquifer related projects, and given numerous presentations on aquifer protection.

Chapter Seven

Contingency Plans

7.0 CONTINGENCY PLANS

Contingency plans need to address the location and provision of alternate drinking water supplies in the event of loss due to contamination or drought.

The EPA Technical Assistance Document called "Guide to Ground Water Supply Contingency Planning for Local and State Governments" (1990) provides valuable information to assist both local and state governments in establishing, maintaining, and updating emergency response procedures in the event of a loss of public water supplies.

7.1 LOCAL CONTINGENCY PLANS

7.1.1 Lead Entity

The water purveyor and/or the local government should be responsible for developing a local contingency plan. Contingency planning should be in cooperation with the community planning team and with advice from IDEQ and the district health departments.

7.1.1.1 Rationale/Discussion

The water purveyor should be involved with the development of a contingency plan because most of the relevant information and responsibilities currently resides with this entity as established by the Idaho Rules Governing Public Drinking Water Systems. Examples of these existing responsibilities are monitoring, record keeping, reporting, and public notification.

7.1.2 Incorporation of Contingency Plans into Other Local Plans

Local contingency plans should be included in the Local Emergency Response Committee plan. In addition, the contingency plan should be distributed to agencies/entities involved with local emergency plans, local planning officials, regulatory agencies, and district health departments.

7.1.2.1 Rationale/Discussion

The authority for local emergency response to a chemical release has been established by the Idaho Hazardous Substance Response Act, Idaho Code, Title 39, Chapter 71 and by the Federal Emergency Planning and Community Right-To-Know Act of 1986, also known as Superfund Amendments and Reauthorization Act, Title III. Because Local Emergency

Planning Committees are required to develop emergency response plans for their communities in the event of a chemical release, it follows that a contingency plan that addresses the contamination of drinking water should also be included.

7.1.3 Local Contingency Plan Implementation

Local contingency plans should be implemented when there is a drinking water violation(s) as defined by the Idaho Rules Governing Public Drinking Water Systems. These plans should be implemented quickly when there are violations of acute contaminants, such as bacteria and nitrate.

In addition, local contingency plans should be readied for implementation if a potential loss of water supply is indicated. The use of Maximum Contaminant Levels (MCLs), trends, and health advisories are recommended to plan contingency implementation actions.

To determine trends, the water purveyor should coordinate with IDEQ and/or the district health departments to interpret monitoring results and also should use information from the Environmental Data Management System (EDMS) which is housed at the IDWR. These interpretations and monitoring results should be shared with other drinking water systems in the area.

7.1.3.1 Rationale/Discussion

Not only should contingency plans be implemented when there is a violation in the drinking water standards, but plans should also be readied for implementation if there is an indication of the potential loss of a water supply. The evaluation of monitoring results, to determine trends or for comparison with MCLs or health advisory levels, will be a useful method to track the development of a potential problem of concern to the public. This information should be shared with other water purveyors in the area, as a contamination problem may impact other systems.

7.2 RECOMMENDED TOPICS IN A LOCAL CONTINGENCY PLAN

Since the State Emergency Plan can only be activated under special conditions, emergency response related to loss of drinking water supplies is primarily the responsibility of the water purveyor and local government. Table 7.1 lists the topics that should be addressed by a local contingency plan.

Table 7.1. Local Contingency Plan Topics

Topic	Recommended Approach
Water system characteristics	♦ Compile current plans and specifications showing the location of all components (source, treatment, distribution and type piping, valves, storage tanks, etc.) ♦ Assess component sizes and capabilities. ♦ Assess system use demands.
Identification of potential emergency situations	♦ Identify potential disruptive events such as contamination, power outage, flood, earthquake, water shortage, loss of pressure, etc.
General response procedures for each emergency situation.	♦ Develop incident assessment guidance to determine the severity and appropriate response to a particular emergency. ♦ Develop step-by-step procedures to be followed in response to a particular emergency. Include a list of names and phone numbers for all federal, state, and local officials that need to be contacted. ♦ Develop guidance on the level of service to be sustained during an emergency and prioritize the uses. This guidance should involve the curtailment of all non-drinking water related activities. ♦ Develop a procedure by which the system users will be notified of the extent of the emergency, actions being initiated, and precautions to be taken. ♦ Assess equipment and manpower needs for specific situations. Assess in-house capabilities to respond and identify additional sources of assistance which may be needed. ♦ Identify funding source(s).
Response procedure for emergency contingency plans. (Emergency contingency plans should cover the time period of 1-2 months following the loss or potential loss, as indicated by trends and health advisories, of a water supply.)	♦ Develop a problem identification procedure. ♦ Develop procedures to provide emergency water supplies[1]. ♦ Identify funding sources. Recommend using readily available resources.
Response procedure for short term contingency plans. (Short term contingency plans should cover the time period of up to 2 years following the loss or potential loss of a water supply.)	♦ Develop a problem identification procedure. ♦ Develop procedures to implement interim solutions[2]. ♦ Identify funding sources[3].

Table 7.1 Continued

Topic	Recommended Approach
Response procedure for long term contingency plans. (Long term contingency plans should cover the time period required to implement a permanent solution for the loss of a water supply.)	♦ Develop a problem identification procedure. ♦ Develop procedures to implement long term solutions. Long term solutions may involve development of alternative sources of drinking water or water treatment. ♦ Identify funding sources[3]. ♦ Develop a procedure for ongoing assessment of the situation and for documentation of all actions taken in regard to the incident. This will be important for enforcement actions. ♦ Begin implementation of the contingency plan to the extent possible before an emergency[4]. ♦ Provide for annual review and possible updating of contingency plans.

[1] Examples include bottled water, use of boil orders, use of surface water, state actions from the Bureau of Disaster Services. The Bureau of Disaster Services is responsible for coordinating the response, recovery, and mitigation operations of all state agencies during a disaster and coordinates all requests from local governments for disaster assistance.

[2] Examples include water conservation measures, replacement of equipment, connection to an adjacent system, and rehabilitation of an abandoned well.

[3] Examples include community block grants (U.S. Department of Commerce or the Idaho Department of Commerce), Farmers Home Administration, bonding, Idaho Legislature, or the Idaho Water Resource Board (Revolving Development Account or Water Management Account).

[4] Examples of pre-emergency actions include finalizing administrative agreements, developing engineering plans, having specification plans reviewed and approved, proceeding on construction, etc.

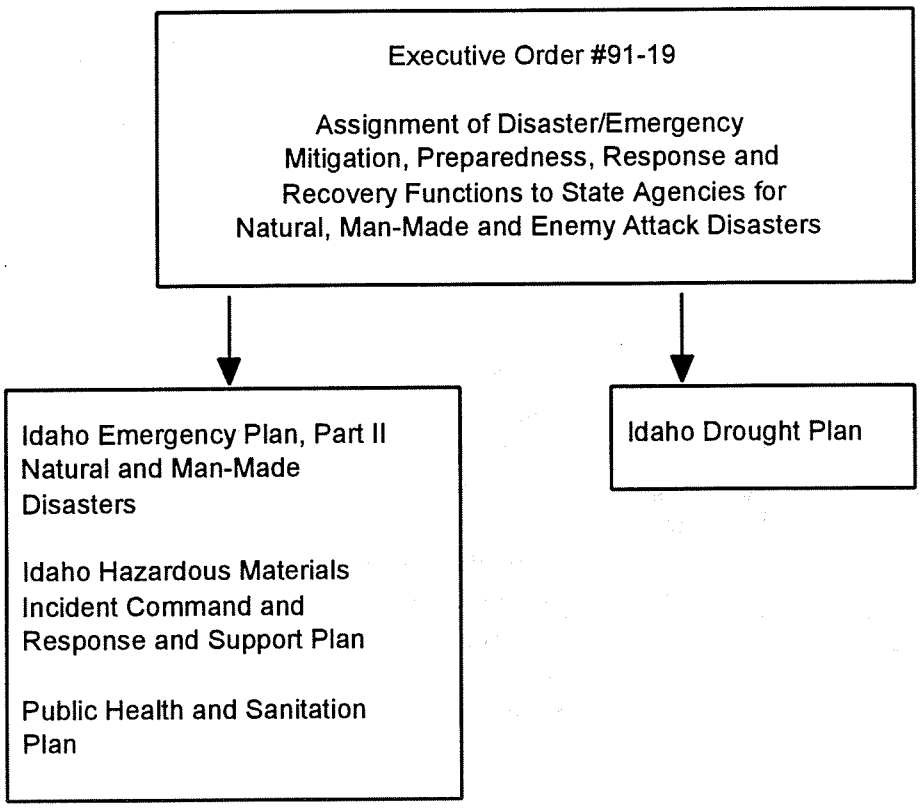
7.3 STATE EMERGENCY PLAN

7.3.1 Relevant State Emergency Plans

The Idaho Hazardous Materials Incident Command and Response Support Plan and the Public Health and Sanitation Plan are annexes to the Idaho Emergency Plan, Part II, Natural and Manmade Disasters. The Idaho Drought Plan has been developed by the Idaho Water Resource Board as appointed by the Governor. The authority for these disaster plans is Executive Order #91-19, Assignment of Disaster/Emergency Mitigation, Preparedness, Response and Recovery Functions to State Agencies for Natural, Man-Made and Enemy Attack Disasters (Figure 7.1).

The primary purpose of the Hazardous Materials Incident Command and Response Plan is to provide effective, coordinated emergency response support to local governments for incidents involving the release or potential release of hazardous materials. This plan may be activated independent of the Idaho Emergency Plan and can be initiated at the request of local governments when their capabilities have been exceeded. Qualifications and procedures to receive state and/or federal assistance is discussed in Annex M of the Idaho Emergency Plan, Part II.

Figure 7.1 State Emergency Plans Relevant to the Idaho Wellhead Protection Program



The purpose of the Idaho Drought Plan is to provide current and historic information, guidance, and a framework for managing future water shortage situations. Although the plan addresses loss of water supply due to drought, the Director of the Idaho Department of Water Resources can, at his/her discretion, activate the plan for other reasons, such as loss of water supply due to contamination. (Anderson, 1992).

Responsibilities of agencies that pertain or could pertain to drinking water emergencies, as designated under the Idaho Hazardous Materials Incident Command and Response Support Plan and/or Public Health and Sanitation Plan and/or the Idaho Drought Plan, are listed in the following tables.

Table 7.2. State Agencies with Relevant State Emergency Plan Roles

State Agencies	
Agency	**Roles**
Department of Agriculture	♦ Provide technical information on pesticides, herbicides, fertilizers, and other agricultural chemicals used in Idaho.
Department of Fish and Game	♦ Act as auxiliary police in the event of a major disaster.
Department of Health and Welfare - Division of Environmental Quality	♦ Assess and evaluate incident environmental risks. ♦ Forewarn users of potentially affected public domestic water systems. ♦ Coordinate environmental investigation and monitoring programs. ♦ Oversee the cleanup and disposal of hazardous wastes, radioactive wastes, and other deleterious materials.
Department of Health and Welfare - Division of Health	♦ Assist in providing technical and health services in the event of a major disaster.
INEL Oversight Program	♦ Advise agencies in the cleanup and disposal of radioactive wastes. ♦ Direct and coordinate investigations and assess risk to the public from radiation incidents.
Department of Law Enforcement - Idaho State Police	♦ Provide law enforcement actions related to a hazardous materials incident.
Public Utilities Commission	♦ Review costs and assist water companies with implementation of corrective actions.
Transportation Department	♦ Assist in providing materials for the containment of hazardous materials.
Department of Water Resources	♦ Assist in the development of emergency or alternate drinking water sources. ♦ Responsible for the Idaho Drought Plan, which includes information on federal and state drought-related and emergency assistance programs.
Executive Office of the Governor-Idaho Emergency Response Commission	♦ Provide technical assistance to local emergency planning committees. ♦ Administer the Idaho Regional Hazardous Materials Response Teams.
Executive Office of the Governor-Bureau of Disaster Services	♦ Coordinate state activities when a state disaster declaration is imminent or declared. ♦ Coordinate all requests for National Guard Support.
Executive Office of the Governor-Idaho National Guard	♦ Assists in providing emergency drinking water sources.
District Health Departments	♦ Forewarn users of potentially affected individual and public domestic water systems under the jurisdiction of the District Health Departments.

Table 7.3. Federal/other Entities with Relevant State Emergency Plan Roles

Federal Agencies	
Agency	**Roles**
Agriculture Department	♦ Has jurisdiction over the National Forest System lands in Idaho.
Department of Defense	♦ Act as the lead response agency within designated National Security areas.
Department of the Interior	♦ Has jurisdiction over the National Park System, National Wildlife Refuges and Fish Hatcheries, Department of Interior public lands, and certain water projects in western states.
Environmental Protection Agency	♦ Initiates containment and cleanup activities, at the request of the state, when the responsible party is unable or unwilling to initiate a cleanup. ♦ Provide environmental response and support, as requested by local or state personnel, to significant spills of hazardous materials.
U.S. Bureau of Reclamation	♦ Administers the Small Reclamation Projects Act Loan Program, Distribution System Loans Act Loan Program, which provides loans for projects that include municipal water supplies.
U.S. Army Corps of Engineers	♦ Provide emergency water supplies when all other reasonable means have been exhausted, during a drought.
National Weather Service	♦ Disseminate to the public and mass news media both weather and other civil emergency response messages when conditions pose an immediate threat to human life and property.
Other Entities	
Indian Nations	♦ Have sovereign powers within federally recognized reservations and will respond to incidents that occur on their reservations. The state will respond if requested by the Indian tribes. ♦ Indian tribes must notify the Emergency Medical Services of incidents that occur on reservations but may impact populations or the environment outside the reservation.

7.4 A DRINKING WATER CONTAMINATION CASE STUDY

The following incident is an example of the difficulties encountered during resolution of a drinking water contamination problem when a contingency plan is not in place. A mobile home park in Idaho was faced with the loss of its water supply because of ground water contamination discovered in June 1990. There were 50 connections affected by the loss of this water supply. This section is a chronological documentation of the actions taken to come to a long-term solution to this problem. If the mobile home association had a contingency plan, this event would have been less disruptive and solved much more quickly.

June 1990 Tetrachloroethylene was discovered in the drinking water well at a concentration greater than 100 parts per billion (ppb).

July 1990 Tetrachloroethylene was detected in the drinking water well at a concentration of 134 ppb. IDEQ confirmed the contamination problem and recommended continuation of the boil water advisory.

Sept. 1990 News release by the Department of Health and Welfare reported that the state would study the contamination problem around the mobile home park.

Dec. 1990 Tetrachloroethylene was detected in the drinking water well at a concentration of 144 ppb.

April 1991 The mobile home park was notified by IDEQ that their water system was disapproved because the levels of tetrachloroethylene were almost double the unreasonable risk to health limit of 70 ppb. The proposed MCL for tetrachloroethylene of 5 ppb was issued by EPA on January 1991.

May 1991 A meeting with mobile home park residents and IDEQ was held to discuss the problem. The residents were reluctant to correct the problem because of the cost; therefore, the EPA, in cooperation with IDEQ, drafted an emergency order. This order called for a plan to be submitted within two weeks that required several provisions: (1) alternative potable water to residents; (2) issuance of a public notice within 72 hours; (3) provisions related to treatment, monitoring, reporting, etc.; and (4) issuance of penalties for non-compliance.

Three possible long term solutions were recommended by the EPA: (1) drill a new well or deepen the existing well; (2) treat the water at the existing source; or (3) hook-up to a nearby water system.

A group of park residents considered the costs of various options and decided to hook up to a nearby water system.

Sept. 1991 The water purveyor completed construction.

Jan. 1992 One of the companies that caused the contamination, as part of a consent order, agreed to reimburse the park residents for the hook-up costs. In addition, the company agreed to pay the first year water bills for the residents.

Chapter Eight

Wellhead Protection for New Wells

8.0 WELLHEAD PROTECTION FOR NEW WELLS

Wellhead protection not only applies to existing wells but also applies to potential and new wells.

8.1 AGENCY RESPONSIBILITIES

The process for drilling a new water well involves several agencies. These agencies and responsibilities are listed in Table 8.1.

Table 8.1 State Agency Responsibilities in Drilling a New Well

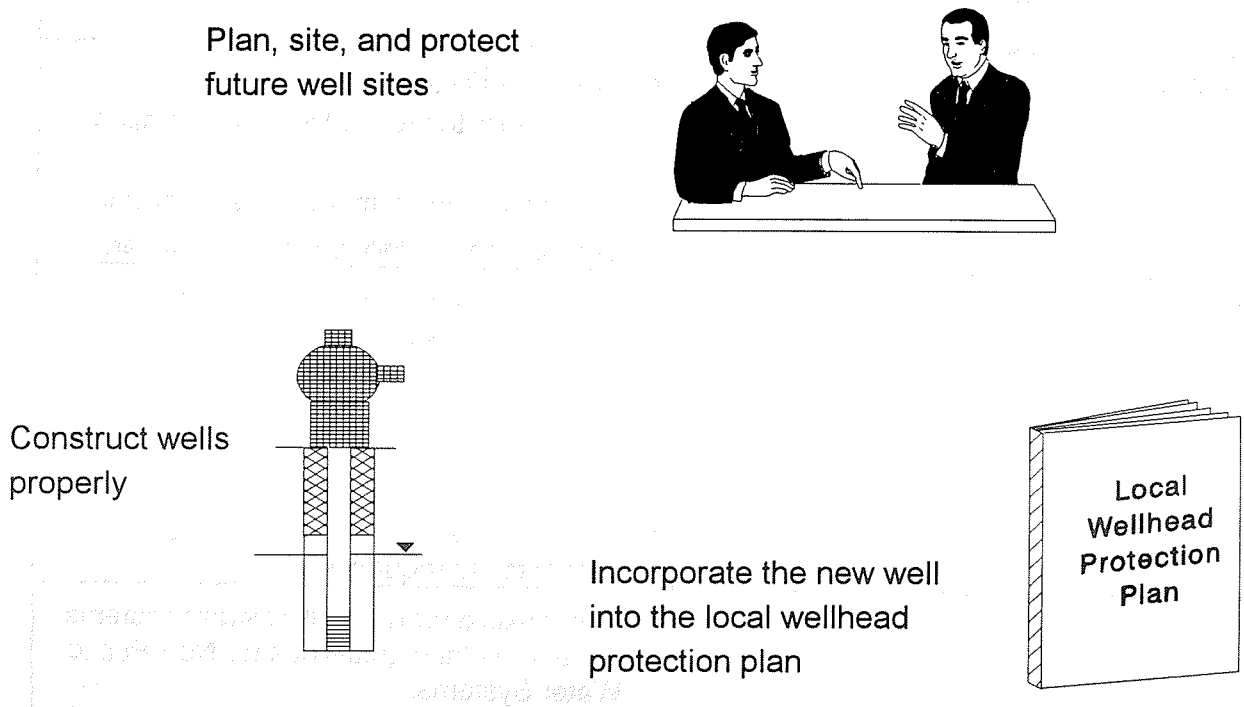
Agency	Role
Idaho Department of Water Resources	♦ Issues drilling permits. ♦ Administers the Idaho Well Construction Rules. ♦ Responsible for administering water rights. ♦ Can petition for drilling areas of concern.
Idaho Division of Environmental Quality	♦ Reviews and approves plans for public water supplies with 15 or more connections. (Idaho Code defines public water *supplies* as *systems* which serve 15 or more connections.) ♦ Approves well lot locations. ♦ Provides advice on wellhead protection concepts, as requested.
District Health Departments	♦ Responsible for non-public water systems under the Idaho guidelines for Non-Public Water Systems. ♦ Responsible for release of sanitary restrictions for water supplies, sewage disposal, and solid waste. The conditions of approval are based on current rules and regulations for water systems and sewage disposal. ♦ Issues permits for new and replacement septic systems under the authority of the Rules for Individual and Subsurface Sewage Disposal.

8.2 MAJOR WELLHEAD PROTECTION ISSUES FOR NEW WELLS

When addressing wellhead protection for new wells, there should be three main topics that are considered (Figure 8.1):

- Planning, siting, and protecting future sites;
- Proper well construction; and
- Incorporating the new well into the existing local wellhead protection plan.

Figure 8.1. Wellhead Protection Topics for New Wells



8.2.1 Plan, Site and Protect Future Drilling Sites

Local governments and water purveyors should cooperate in the effort to plan, site, and protect future drilling sites. Future well sites should be located in areas with as few potential sources of contamination as possible and the site should be reserved and protected for this specific use. Plans for drilling future wells should be incorporated into the

comprehensive land use plan and the community should use one of the basic methods (Basic I or II) to define the wellhead protection areas. The contamination potential in the protection area should be evaluated before a final well site is chosen.

The Rules Governing Public Drinking Water Systems requires that new community water systems constructed after July 1, 1985, have a minimum of two sources if they serve more than 25 homes. The Wellhead Protection Work Group recommends that these two sources be located as far apart as possible.

8.2.1.1 Rationale/Discussion

Cooperation between local governments and water purveyors in planning future water supply wells is essential for two main reasons. One, from an implementation standpoint, the water purveyor will only be able to locate future water supply wells, especially if the purveyor is privately owned, but the local government has the authority to enact protective measures for wellhead protection areas. Secondly, functions necessary to operate a city or county need to be planned cooperatively with the appropriate entities.

It is recommended to use the basic delineation approach until a well is developed and tested as very little specific information will be known. Local governments or water purveyors are not expected to use resources to define a refined delineation when the quality and quantity of the potential well is yet unknown, unless there is extensive nearby hydrogeologic data available.

The drinking water regulations state that a community water system constructed after July 1, 1985, must have at least two sources, but it does not specify where the sources should be located. To reduce the possibility of losing both the primary and backup source to the same contamination event, the Wellhead Protection Work Group recommends that these wells be located as far apart as possible.

8.3 WELL CONSTRUCTION

At a minimum, wells must be constructed in accordance with Idaho Department of Water Resources Rules. Water purveyors should also ensure that wells are constructed such that the surface seal prevents the movement of surface contaminants immediately around the wellhead from entering the well. In cases where water quality is questionable, water purveyors may want to prevent the interconnection of aquifers.

8.3.1 Rationale/Discussion

Many contamination events in drinking water wells are believed to be due to the introduction of contaminants from the surface via the annular space or introduced from a shallow aquifer to a deeper aquifer because of inappropriate well construction. A wellhead protection plan for new wells needs to address these concerns to be a comprehensive prevention plan.

8.4 INCORPORATION OF NEW WELLS INTO LOCAL PLANS

The delineation approach for new wells should follow the assessment guide in Chapter 4 (Figure 4.5). The management of wellhead protection areas for new wells should be at least as stringent as management for existing wells. The management of wellhead protection areas for existing wells is discussed in greater detail in Chapter 6.

8.4.1 Rationale/Discussion

Planning a new well, with the concepts of wellhead protection in mind, offers a community an opportunity to provide the best possible protection for that well. The delineation and management of the new wellhead protection area should be at least as stringent as for existing wells. If desired, a community that chooses to use the basic delineation approach for existing wells may use a refined delineation approach for new wells.

Chapter Nine

Public Participation and Education

9.0 PUBLIC PARTICIPATION AND EDUCATION

Public participation was included throughout the development of the Idaho Wellhead Protection Program. This was essential because the major responsibility for implementation rests on the local community. Local community representatives can help build a practical program that can be truly implemented.

Public education has been identified as the cornerstone of the Idaho Wellhead Protection Program. This factor is critical because there can only be support for the program if the public understands basic ground water and drinking water concepts. This understanding will enable communities to realize that wellhead protection is in their best interest. Once the community decides to initiate a wellhead protection plan, the Idaho Wellhead Protection Program will provide guidance on how to prevent drinking water from becoming contaminated.

9.1 PUBLIC PARTICIPATION

The Safe Drinking Water Act Amendments of 1986 states that "to the maximum extent possible, each state shall establish procedures, including but not limited to the establishment of technical and citizens' advisory committees, to encourage the public to participate in developing the protection program for wellhead areas..."

The Idaho Wellhead Protection Plan was developed by the Wellhead Protection Work Group and a subgroup, the Technical Task Force. These two groups are discussed in Program Summary, Purpose, Development, and General Policies in Chapter 2.

9.1.1 Public Participation Procedure

The Safe Drinking Water Act Amendments of 1986 further states that "such procedures shall include notice and opportunity for public hearing on the state program before it is submitted to the administrator."

There are several methods that have been used to solicit public comment on the plan. These methods included:

- use of an advisory committee to develop the plan;
- news releases giving notice that the plan is available for review;

- flyers mailed to water purveyors, city/county officials, and interested citizens, announcing that the plan is available for comment; and
- workshops held in different areas of the State.

9.1.2 Specifics of Public Participation Procedure

The Idaho Wellhead Protection Program was developed by IDEQ and two advisory committees, the Wellhead Protection Work Group and the Technical Task Force. The advisory committees were comprised of representatives of small and large water systems, city/county planning and zoning, well drillers, irrigation users, citizen groups, and state and federal agencies. A list of the participants are given in Appendix C. In addition, all meetings were open and several other water system operators and private citizens attended the meetings. Agendas, meeting minutes, and notification of meeting times and locations were provided. The mailing list developed as people expressed interest following presentations at conferences/workshops or after reading articles in newsletters (DEQ, Idaho Building Contractors Association). Twenty advisory committee meetings were held between June 1991 and March 1994.

In 1992, IDEQ announced that the plan was available for review and was seeking comments. This was accomplished by using the following mechanisms.

- Flyer which was mailed out to all the system operators and the legislators in the State in July 1992. This flyer asked for comments on the plan and generated interest in the workshops.

- News release by the Department of Health and Welfare on August 18, 1992. This news release announced that IDEQ was seeking comments on the plan and was providing 5 public workshops across the State. These workshops were held at the following locations:
  - Boise, August 24, 1992
  - Twin Falls, August 25, 1992
  - Pocatello, August 27, 1992
  - Coeur d'Alene, September 9, 1992
  - Moscow, September 10, 1992.

- Advertisement of workshops and request for comments in five local newspapers. The contractor for the workshops purchased advertisement space in the Moscow-Pullman Daily News, Eastern Idaho Farm and Ranch (Idaho Falls), Times News (Twin Falls),

Idaho State Journal (Pocatello), Coeur d'Alene Press, and the Idaho Statesman (Boise).

- Workshop Brochure. This brochure indicated that the workshops would provide a forum for public comment. At the workshop, the concepts of hydrogeology, contaminant sources, and the policies of the Idaho Wellhead Protection Program were introduced in the morning session. Time for questions and discussion were scheduled after each presentation. In the afternoon session, the participants worked together to "develop" a local wellhead protection program in a fictional community. A workbook covering the workshop topics was given to each participant.

Other full day wellhead protection workshops, with time allotted for questions or comments, also were conducted. These workshops were sponsored by the Idaho Rural Water Association. The topics addressed included basic hydrogeology, ground water contamination, and concepts and policies of the Idaho Wellhead Protection Program. The audience that attended these workshops were mostly water system operators and elected officials. The locations and dates were:

- Boise, January 31, 1994
- Nampa, February 1, 1994
- Pocatello, February 3, 1994
- Sandpoint, February 10, 1994
- Lewiston, August 16, 1994
- Burley, August 18, 1994

In addition, the following presentations on wellhead protection were conducted:

- Community Education Class, Boise, February 6, 1992
- Environmental Health Conference, Boise, March 10, 1992
- AWWA Preconference, Portland, May 6, 1992
- Field Office/District Health Dept., Coeur d'Alene, July 28, 1992
- Field Office/District Health Dept., Lewiston, July 28, 1992
- Field Office/District Health Dept., Boise, July 30, 1992
- Field Office/District Health Dept., Twin Falls, August 5, 1992
- Field Office/District Health Dept., Pocatello, August 6, 1992
- Idaho Planning Association Conference, Nampa, September 30, 1992
- Community Education Class, Boise, November 17, 1992
- Community Education Class, Boise, December 1, 1992
- Idaho Water Users Association Conference, Boise, December 11, 1992
- Environmental Health Conference, Boise, March 9, 1993
- Idaho Groundwater Association Conference, McCall, July 12, 1993
- BSU Water/wastewater class, Meridian, September 8, 1993

- BSU Water/wastewater class, Meridian, September 23, 1993
- Idaho Drinking Water Staff, Boise, April 6, 1994
- BSU water/wastewater class, Meridian, September 14, 1994
- Small Systems Workshop, Twin Falls, November 9, 1994
- Idaho Rural Water Association Conference, Lewiston, March 8, 1995
- Field Office, Lewiston, March 8, 1995
- Environmental Health Conference, Boise, March 16, 1995

9.2 PUBLIC EDUCATION

The educational efforts for the Wellhead Protection Program will be made in accordance with Policy III-A of the Ground Water Quality Plan. In addition, the Wellhead Protection Program will coordinate educational efforts with the State Drinking Water Program.

Because the Wellhead Protection Program involves such a broad scope of issues, topics, and skills, education efforts will be coordinated to ensure that precise information is disseminated and that the efforts are effective. These efforts will involve other entities such as the Department of Health and Welfare public information office, other state agency programs, federal agencies, the public and private school systems, and public entities or citizens groups.

9.2.1 Material Development

Public education and material can be developed by IDEQ as program funds allow. Consultation with the Wellhead Protection Work Group or Technical Task Force members may be requested.

Types of education materials that may be developed or collected include:

- brochures;
- slide shows;
- workbooks/workshops;
- videos; and
- reference materials in IDEQ regional offices or Central Office.

Chapter Ten

Program Implementation

10.0 PROGRAM IMPLEMENTATION

This chapter describes the strategy for implementing the Wellhead Protection Program in Idaho. The discussion will include the general implementation approach, the elements involved with this implementation approach and implementation activities for each of the Idaho Wellhead Protection Program components.

10.1 GENERAL IMPLEMENTATION APPROACH

In Idaho, the Wellhead Protection Program is voluntary for local governments and water suppliers to implement. A voluntary program means that local governments and water suppliers will be encouraged, but are not required to develop a local wellhead protection program. This approach will best meet the needs of Idaho in consideration of several reasons. Some of these reasons include the need for ground water protection education, a wide diversity in system sizes and needs, and consistency with the policy of the Ground Water Quality Plan, 1992. The Ground Water Quality Plan states that voluntary programs should be developed first, and mandatory programs should be developed when voluntary programs are not successful. A complete discussion on the reasons are provided in Chapter 2.

To ensure that a voluntary wellhead protection program is successful, the State of Idaho has developed a strategy for guiding implementation of the program. The five main elements of this strategy include:

- Coordination with other related programs;
- Education and outreach;
- Incentives;
- Technical assistance; and
- Funding assistance.

A summary of the implementation strategy is shown in Table 10.1.

Idaho will focus implementation efforts on wells or springs that regularly serve a population year round. This would include:

- Public community water systems; and
- Non-public water systems.

By targeting these wells or springs, it is expected that the prevention efforts will benefit a majority of Idaho's population.

Table 10.1 Summary of the Implementation Strategy

Element	Description
Coordination with other programs	Purpose is to: ♦ promote wellhead protection concepts; ♦ help facilitate state or federal permitting, enforcement, remediation, etc. activities in recognized wellhead protection areas; and ♦ form partnerships to provide technical assistance to interested communities.
Education and Outreach	IDEQ will: ♦ develop educational material; ♦ conduct workshops; ♦ give presentations; and ♦ work with other agencies and organizations to reach communities, water suppliers, or individuals that use ground water for drinking water.
Incentives	IDEQ will: ♦ develop incentives, with programs such as the Drinking Water Monitoring Waiver Program to encourage communities to develop a local wellhead protection program.
Technical Assistance	IDEQ will: ♦ develop guidance; ♦ compile information references; ♦ provide training for pertinent staff; ♦ coordinate technical assistance efforts with the Idaho Rural Water Association; and ♦ work with other programs and agencies to enhance the technical assistance capacity of the state.
Funding Assistance	IDEQ will: ♦ seek funding opportunities from federal and state sources to assist those communities that choose to enhance the quality of their local wellhead protection program with projects such as hydrogeologic studies, evaluation of best management practices, etc.

10.2 IMPLEMENTATION STRATEGY ELEMENTS

As presented under General Implementation and in Table 10.1, there are five main elements of Idaho's strategy for guiding program implementation. These elements are discussed in the following sections.

10.2.1 Coordination with Other Related Programs

Because the Idaho Wellhead Protection Program is not a stand alone program, IDEQ will establish "connections" with other agencies to more effectively administer the program. These connections may be formal agreements between agencies. For example, a Ground Water Protection Interagency Cooperative Agreement between IDEQ, IDWR and IDA has been developed. Wellhead Protection Program implementation is specifically addressed under the Program Coordination part of the Agreement. Other coordination efforts may be less formal but the intent of the coordination, as it pertains to wellhead protection, would be to:

- Promote wellhead protection concepts;
- Help facilitate state or federal enforcement, permitting, remediation, etc. activities within recognized wellhead protection areas; and
- Form partnerships to provide technical assistance to interested communities.

Coordination efforts will be developed with the many ground water related programs as shown in Figure 10.1. Coordination with the following related programs or activities has already been started:

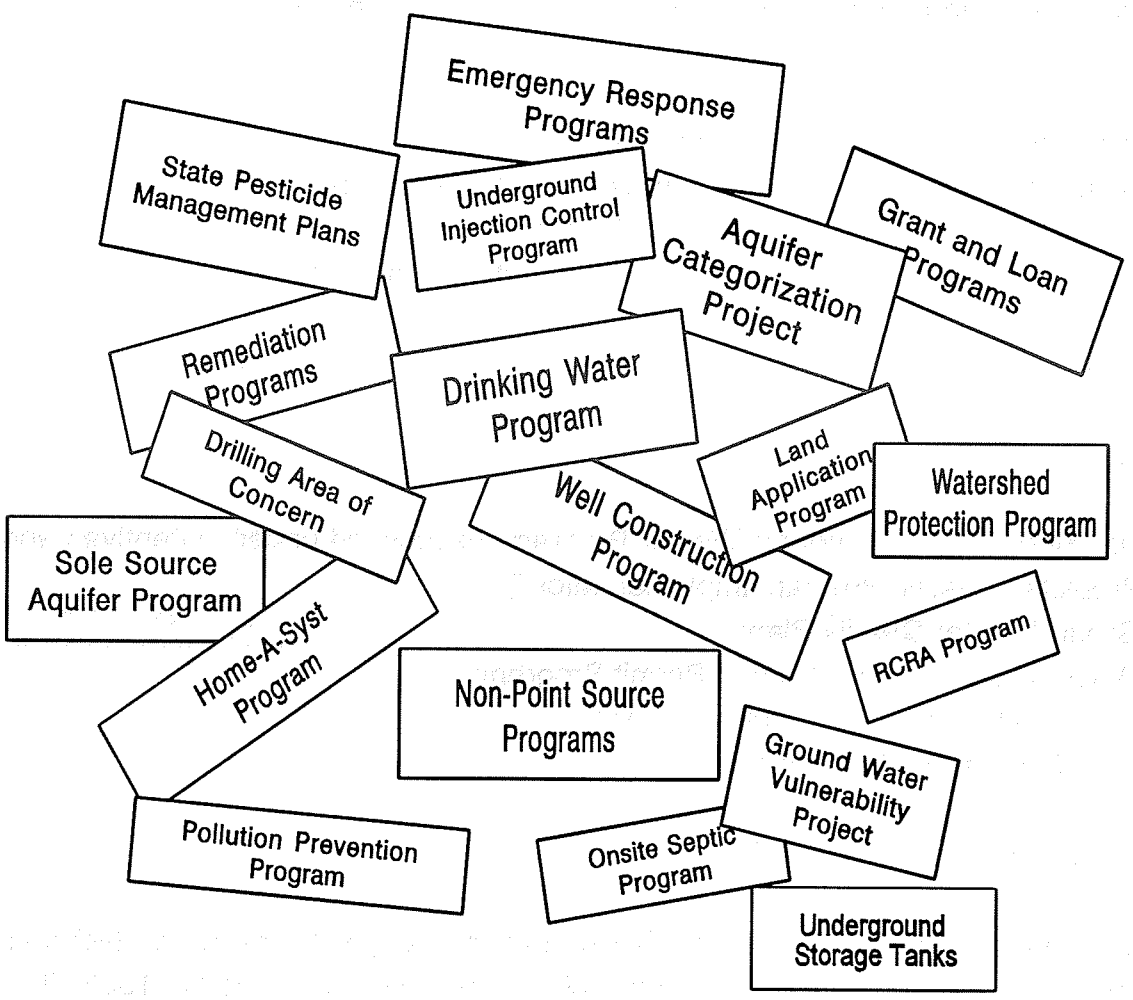
- Drinking Water Monitoring Waiver Program, (discussed under "Incentives and Projects to Assist Program Implementation");
- Ground Water Quality Plan;
- Wastewater Land Application Permit Program;
- Pollution Prevention Program; and the
- Sole Source Aquifer Program.

10.2.1.1 Ground Water Quality Plan

In 1989, the Idaho Legislature enacted the Ground Water Quality Protection Act, which was the authority for the development of the Ground Water Quality Plan adopted in 1992. The Ground Water Quality Plan describes Idaho's overall approach to protecting its ground water. The major component of the Plan is the Ground Water Quality Policies section.

Some of the key policies address ground water protection, prevention of contamination, public education, government interaction, and public participation. Development of a statewide Wellhead Protection Program is identified as an implementation item under Policy II-A: "Prevention of Ground Water Contamination". Wellhead Protection will also support implementation of many of the other policies within the Plan.

Figure 10.1 Programs and Activities to be Coordinated with the Wellhead Protection Program



10.2.1.2 Wastewater Land Application Permit Program

Wellhead protection concepts have been incorporated into guidelines for the Wastewater Land Application Permit Program. These guidelines direct a land application permittee to include wellhead protection concepts and to coordinate and be consistent with any local management strategies, particularly if the facility is located in a wellhead protection area. This process will ensure that wellhead protection concepts have been incorporated into the permit evaluation process and where appropriate, will be incorporated as a permit condition.

10.2.1.3 Pollution Prevention Program

The IDEQ has initiated a Pollution Prevention Program and has formed a focus group to coordinate the prevention objectives and actions in programs within the agency. The focus group has set objective priorities and will assist in the development of educational and technical assistance efforts. The materials and workshops that will be developed by this program will be very useful toward implementation of the source management component of the Wellhead Protection Program.

10.2.1.4 Sole Source Aquifer Program

The Wellhead Protection Program in Idaho has been coordinated with the federal Sole Source Aquifer Program. Pursuant to section 1424(e) of the Safe Drinking Water Act, the EPA can designate an aquifer as a sole source aquifer. A sole source aquifer is an aquifer which supplies at least 50% of the drinking water consumed in the area overlying the aquifer. Also, there are no alternative drinking water source(s) which could physically, legally, and economically supply all those who depend upon the aquifer for drinking water. As a result of this designation, federal financially-assisted projects proposed in the project area will be subject to review by the EPA to ensure that the projects are designed and constructed to protect water quality. Communities over sole source aquifers that seek federal funding to drill new drinking water wells have been encouraged to implement wellhead protection strategies for the new well. The sole source aquifers in Idaho are the:

- Rathdrum Prairie Aquifer;
- Eastern Snake River Plain Aquifer; and
- Lewiston Basin Aquifer.

10.3 EDUCATION AND OUTREACH

Communities and water suppliers will implement wellhead protection only if they understand the benefits and decide that the effort is in their best interest. To promote wellhead protection concepts, IDEQ will coordinate education and outreach efforts with other programs and organizations that are concerned with water quality. IDEQ can develop educational materials, conduct workshops or give presentations to reach those communities, water suppliers, or individuals who are dependent on ground water for their drinking water.

10.4 INCENTIVES AND PROJECTS TO ASSIST PROGRAM IMPLEMENTATION

In addition to education and outreach, incentives will be used to further encourage communities and water suppliers to develop and implement local wellhead protection plans. At this time, the IDEQ is developing, in more detail, an incentive relating drinking water monitoring waivers and wellhead protection. Drinking water monitoring waivers may be related to chemical compounds or may help a water system comply with requirements under the surface water treatment rule if groundwater is found to be under the influence of surface water.

The Wellhead Protection Program has initiated the link with the drinking water monitoring waivers by developing delineation guidelines consistent with the drinking water monitoring waiver time frames (3, 6, and 10-year time of travel boundaries). The 3, 6 and 10-year time of travel boundaries should be used as the waiver process will eventually involve evaluation of potential sources of contamination within the time of travel zones around a wellhead. This evaluation will determine whether the system is eligible for reduced frequency of monitoring for Phase II/V volatile organic compounds and synthetic organic compounds. On the monitoring waiver application form it has been indicated that the process of evaluation may be simplified if a local wellhead protection program is developed. Waiver application forms and additional information can be obtained from any IDEQ regional office. As the waiver and Wellhead Protection Program evolve, efforts will be made to further links wherever possible.

Other incentives or projects that may be developed to assist implementation of local wellhead protection programs include coordination with state grant and loan programs and coordination with other programs or entities on mutually beneficial projects.

10.5 TECHNICAL ASSISTANCE

Most communities will be more likely to implement wellhead protection if they are provided technical assistance. Also, some communities or water suppliers are very interested in developing and implementing a local wellhead protection program, but are not sure how to get started or where to get information. As resources allow, the IDEQ will help meet these needs by:

- Developing written guidance and technical information;
- Compiling information references;
- Providing training for pertinent staff;
- Coordinating efforts with the Idaho Rural Water Association;
- Working with other programs and agencies; and
- Providing hands on assistance to communities.

The Wellhead Protection Work Group and Technical Task Force recommended that guidance be developed to assist local governments in implementing local wellhead protection programs. The purpose and scope of this guidance is to provide reference information, organizational ideas, data collection forms and other useful program implementation tools.

Technical assistance to rural communities has been provided by the Idaho Rural Water Association through a contract with the National Rural Water Association and the EPA. The Idaho Rural Water Association promotes wellhead protection in communities of fewer than 10,000 people. Approximately 94% of the cities in Idaho would be considered rural under this definition. The estimated populations of cities in Idaho (1990 Census) are shown in Table 10.2.

As referenced above, the IDEQ will work with other agencies and programs to provide technical assistance to communities that are implementing wellhead protection. Much of this technical assistance will be related to managing potential sources of contamination within wellhead protection areas.

Table 10.2. Estimated Populations of Cities in Idaho (1990 Census)

Pop. Rank	City	1990 Pop.	Pop. Rank	City	1990 Pop.	Pop. Rank	City	1990 Pop.
1	Boise	125,738	56	Parma	1,597	111	Franklin	478
2	Pocatello	46,080	57	Osburn	1,579	112	Lewisville	471
3	Idaho Falls	43,929	58	Priest River	1,560	113	Smeiterville	464
4	Nampa	28,365	59	Filer	1,511	114	Nez Perce	453
5	Lewiston	28,082	60	Aberdeen	1,406	115	Ponderay	449
6	Twin Falls	27,591	61	New Plymouth	1,313	116	Clark Fork	448
7	Coeur d'Alene	24.563	62	Glenns Ferry	1,304	117	Riggins	443
8	Moscow	18,519	63	Bellevue	1,275	118	Firth	429
9	Caldwell	18,400	64	Sugar City	1,275	119	Lava Hot Springs	420
10	Rexburg	14,302	65	Shoshone	1,249	120	Dubois	420
11	Blackfoot	9,646	66	Wilder	1,232	121	Moyie Springs	415
12	Meridian	9,596	67	Kamiah	1,157	122	Basalt	407
13	Burley	8,702	68	Ashton	1,114	123	Hazelton	394
14	Mountain Home	7,913	69	Challis	1,073	124	Bancroft	393
15	Chubbuck	7,791	70	Iona	1,049	125	Weston	390
16	Post Falls	7,349	71	Arco	1,016	126	Richfield	383
17	Jerome	6,529	72	Wallace	1,010	127	Notus	380
18	Garden City	6,369	73	Grace	973	128	Hauser	380
19	Payette	5,592	74	Sun Valley	938	129	Newdale	377
20	Rupert	5,455	75	Lapwai	932	130	Cambridge	374
21	Sandpoint	5,203	76	Paul	901	131	Fairfield	371
22	Ammon	5,002	77	Ucon	895	132	Dayton	357
23	Emmett	4,601	78	Cascade	877	133	Athol	346
24	Weiser	4,571	79	Hansen	848	134	Hayden Lake	338
25	American Falls	3,757	80	Driggs	846	135	Grandview	330
26	Hayden	3,744	81	Council	831	136	Kootenai	327
27	Preston	3,710	82	Cottonwood	822	137	Kendrick	325
28	Hailey	3,687	83	Mullan	821	138	Idaho City	322
29	Shelley	3,536	84	Plummer	804	139	Eden	314
30	Buhl	3,516	85	Marsing	798	140	Arimo	311
31	Eagle	3,327	86	Spirit Lake	790	141	Albion	305
32	Grangeville	3,226	87	Potlatch	790	142	Dover	294
33	Soda Springs	3,111	88	Inkom	769	143	Victor	292
34	St. Anthony	3,010	89	Pierce	746	144	Parker	288
35	Salmon	2,941	90	Genesee	725	145	Culdesac	280
36	Orofino	2,868	91	McCammon	722	146	Declo	279
37	Gooding	2,820	92	Troy	699	147	Rockland	264
38	Heyburn	2,714	93	Kooskia	692	148	Winchester	262
39	Rigby	2,681	94	Greenleaf	648	149	Bovill	256
40	Montpelier	2,656	95	Horseshoe Bend	642	150	Melba	252
41	Kellogg	2,591	96	Oakley	635	151	Warchner	246
42	Ketchum	2,523	97	Downey	626	152	Clifton	228
43	St. Maries	2,442	98	Menan	601	153	Harrison	226
44	Fruitland	2,400	99	Hagerman	600	154	East Hope	215
45	Kimberly	2,367	100	Ririe	596	155	Stites	204
46	Bonners Ferry	2,193	101	Paris	581	156	Onaway	203
47	McCall	2,005	102	Mackay	574	157	Bloomington	197
48	Rathdrum	2,000	103	Teton	570	158	Moore	190
49	Homedale	1,963	104	Georgetown	558	159	St. Charles	189
50	Wendell	1,963	105	Roberts	557	160	Bliss	185
51	Kuna	1,955	106	Craigmont	542	161	Worley	182
52	Dalton Gardens	1,951	107	New Meadows	534	162	Mud Lake	179
53	Malad	1,946	108	Weippe	532	163	Castleford	179
54	Middleton	1,851	109	Deary	529	164	Malta	171
55	Pinehurst	1,722	110	Juliaetta	488	165	Fernan Lake	170

10.6 FUNDING ASSISTANCE

The Idaho Wellhead Protection Program has been developed so that a local program could be developed without supplemental funding. However, there have and may be situations that require more in depth studies or professional assistance. Some wellhead protection related projects have been funded through federal or state funds, as described in the following paragraphs. Funding is very limited, but opportunities will be sought whenever possible.

10.6.1 Federal Funds

Wellhead protection demonstration grants were available to local governments from the Environmental Protection Agency until 1992. Two communities, Boise and Pocatello, applied and were awarded these grants. These projects are discussed under "Management of Potential Sources of Contamination", (Chapter 6). It is unknown at this time whether the funds for these grants will be reinstated.

IDEQ has also assisted in two projects using federal funds that were granted to the state for program development. These projects are listed below.

- A joint project between Newport, Washington and West Bonner Water District in Oldtown, Idaho. The Idaho portion of the project was financed from wellhead protection program carryover funds from federal fiscal year 1990. This project is discussed in greater detail in Chapter 6.

- A depth-to-water project to assist the city of Boise in developing land use ordinances. This project was funded from wellhead protection program carryover funds from federal fiscal year 1990.

Note: Carryover funds are only available on a one time, case-by-case basis.

The Rural Development Administration through the Farmers Home Administration issued a notice in December 1993 clarifying the policy for funding wellhead protection costs through the Water and Waste Disposal Loan and Grant Fund Program. Wellhead protection costs are eligible only if in conjunction and necessary for projects that involve new construction or renovation to an existing system. Wellhead protection efforts eligible for funding include:

- Studies to delineate the protection area;
- Vulnerability assessments;

- Development of enforcement and/or regulatory requirements in wellhead protection areas; and
- Purchase of land rights.

Eligible entities must be from rural areas and towns up to 10,000 people and must:

- Be unable to obtain needed funds from other sources;
- Have the legal capacity to borrow and repay loans to pledge security for loans and to operate and maintain the funded facility or service;
- Be financially sound and able to manage the facility; and
- Have a financially sound basis to pay facility costs and to retire the indebtedness as well as maintain a reserve.

10.6.2 State Funds

There have been some state funded projects which directly benefit the implementation of the Idaho Wellhead Protection Program. One of these is the ground water vulnerability project.

In 1993, the IDEQ contracted with the Idaho Geological Survey to investigate the geology and unsaturated zone in the Jerome, Idaho area. The results from this study were incorporated into a larger project that will assess ground water vulnerability. The ground water vulnerability project will assist the community in the area in the inventory of potential sources of contamination and in understanding the vulnerability of their aquifer on a local rather than regional scale. The funding for this contract was the Snake River Plain Aquifer 1993 appropriation, which is an annual appropriation designated for "implementing ground water quality management strategies on the Snake River Plain Aquifer."

10.7 WELLHEAD PROTECTION PROGRAM COMPONENTS

The 1986 Safe Drinking Water Act Amendments require that each state wellhead protection program address the seven program components presented in Chapter 2 of this plan. These components represent the elements that a local wellhead protection program should address for state certification as discussed under the State Review and Certification Process for Local Plans in Chapter 2. The following is a summary of how the Idaho Wellhead Protection Program will help implement each of the program components.

10.7.1 Roles and Duties

Chapter 3 of this plan defines general roles and responsibilities at the federal, state and local levels. The ways in which these roles and responsibilities specifically relate to implementation of the other components is further developed throughout the remaining chapters. It is anticipated that further guidance will be developed to assist with program implementation efforts. This guidance may include:

- Suggested committee/responsibility flow charts;
- General procedure recommendations;
- Case study examples;
- Further definition of roles and responsibilities, possibly through interagency agreements, memorandum of understandings, or similar documents; and
- Additional IDEQ program policies.

10.7.2 Wellhead Protection Area Delineation

Chapter 4 of this plan provides wellhead protection area delineation guidance based on available hydrogeologic information for Idaho. Various levels of complexity can be utilized in developing the wellhead area delineation for a specific wellhead. Through the use of Basic I Method, any community can delineate a wellhead protection area using the information in this plan in conjunction with well pumping data. With additional site specific hydrogeologic information, a more accurate wellhead area can be defined through the Basic II Method or a Refined Method. IDEQ will assist with the delineation of wellhead protection areas for those communities using the Basic I and Basic II Methods to the extent possible.

IDEQ also intends to provide technical guidance to assist with wellhead area delineation efforts. This guidance will likely include information pertaining to the following:

- Basic hydrogeologic concepts;
- Reference sources;
- Basic I Method;
- Basic II Method;
- Refined Method;
- Refined Exception Method; and
- Special Case (Aquifer Protection).

At this time there is limited information and resources for local governments to develop wellhead protection programs using refined delineations. However, as cities grow and

need to provide larger quantities of drinking water, understanding the aquifer from which this resource's derived will become more important.

IDEQ will promote the refined delineation by:

- Providing information to local governments when grants become available;
- Developing joint projects with universities or colleges and other state agencies to obtain aquifer characterization information; and
- Searching for funding sources that could be used for delineation purposes.

It is envisioned that most of the larger communities in Idaho will use the refined delineation approach. The smaller communities will be informed of the benefits of the refined and the Basic II delineation methods. However, without dedicated technical assistance and funding, progress will be difficult.

Use of the refined delineation may also be encouraged by the Drinking Water Monitoring Waiver Program. The specific policies to define the relationship of the refined delineation and the waiver program is yet to be established.

10.7.3 Inventory of Potential Sources of Contamination

Chapter 5 of this plan provides guidance that a local community can use to assist with inventory efforts. A detailed listing of potential sources of contamination is also provided within this chapter. One of the challenges in accomplishing a complete inventory of potential sources of contamination will be finding the various sources of data to assist with this effort. Once found, the data source may, or may not meet the need and goals of the community. To assist a community in completing this Wellhead Protection Program component, IDEQ will help develop the following tools:

- Reference sources and the available data;
- Inventory form(s);
- Time frames for updates;
- General guidance on prioritizing sources;
- Ideas for inventory information organization; and
- Information on how other communities have performed their inventories.

10.7.4 Management of Potential Sources of Contamination

In addition to the guidance provided within Chapter 6 and other areas of this plan, IDEQ will provide technical input and assistance in the area of contaminant source control where appropriate. Additional guidance and assistance will include the following.

10.7.4.1 Compendium of Ordinances

The EPA has compiled a compendium of ordinances from communities nationwide on wellhead and general ground water protection. This source will provide models for those communities that choose this method of management. Interested parties will need to contact the IDEQ, Central Office.

10.7.4.2 Guidance Development

IDEQ will develop further guidance that will address some or all of the following topics:

- Reference sources;
- Implementation methods;
- Guidance for local coordination; and
- Example management methods, including information pertaining to how different Idaho communities are implementing this important component.

10.7.4.3 Coordination With Other State Agencies

Management of wellhead protection areas will be accomplished more effectively if efforts are coordinated with state agencies that have regulatory authority over the potential sources of contamination found in the area. Therefore, those agencies that regulate potential sources of contamination found in the wellhead protection area will be formally notified and included in the wellhead protection program technical assistance and certification processes as appropriate.

10.7.5 Contingency Plans

Although the wellhead protection program focuses on pollution prevention, there are no guarantees that a contamination event will not occur. Thus, it is important that communities plan contingency actions as described within Chapter 7 of this plan. This, in particular, will be very important if a community chooses to use the Refined Exception Method of

delineation. Further guidance or assistance, in addition to what is available within this plan, may include the following:

- Specific sources of information;
- Suggested contingency plan topics, including topics that may be specific to a region or specific area;
- Agencies, entities, and other programs that should be involved; and
- Example contingency plans.

10.7.6 Wellhead Protection for New Wells

Locating and drilling a new well with wellhead protection concepts in mind will be a very important part of any local wellhead protection program. For public water wells the procedure, i.e. necessary agency permits, approvals, and drilling requirements, will be emphasized. Suggested procedures and information sources also will be compiled for those intending to drill non-public water wells.

In addition to the guidance within Chapter 8 of the Plan, additional guidance may include:

- Reference sources;
- Procedure flow chart - drilling of public water wells; and
- Procedure flow chart - drilling of non-public water wells.

IDEQ will work with agencies, such as IDWR and the health districts, to provide information on wellhead protection for those who intend to drill new drinking water wells.

10.7.7 Public Education and Participation

Public education is a major component of the Idaho Wellhead Protection Program. Education efforts are already underway through coordination with the Drinking Water Program, Pollution Prevention Program, Home-A-Syst Program, and through an education grant from the Environmental Protection Agency. Additional sources of ground water education material will be provided as part of Idaho's efforts to help implement wellhead protection.

10.7.7.1 Drinking Water Program

The Drinking Water Program has provided a Technical Assistance Notebook for all public water system operators. The intent of this notebook is to provide technical guidance so

system operators can understand and meet federal and state requirements. Information will periodically be sent to the operators which then can be filed under one of the eight general categories of the notebook. Topics pertaining to wellhead protection can be sent to system operators through this method of communication.

The Drinking Water Program sends a quarterly bulletin to public water system operators. This bulletin provides updated information that directly affects the day-to-day operations of a public water system, such as new monitoring requirements. Other relevant topics, such as policies linking the Wellhead Protection Program and the Drinking Water Program also may be conveyed to the operators through the bulletin.

10.7.7.2 Pollution Prevention Program

The IDEQ Pollution Prevention Program will continue to hold educational workshops that will assist facilities in reducing the amount of generated wastes. An activity that was well received has been the workshop focusing on fleet maintenance. Future workshops will target pollution prevention activities related to agricultural crop production, auto repair shops, chemicals and chemical production, metal mining, and lumber and wood products.

Besides organizing workshops, the program staff also anticipates developing a list of speakers, both inside and outside of the IDEQ, who could give presentations on specific pollution prevention activities. This list will be helpful for communities who need reference sources for presentations or technical assistance.

The Pollution Prevention Program staff will also:

- Develop materials that can be incorporated into presentations given by any IDEQ staff;
- Develop a library of pollution prevention articles; and
- Organize groups to assist in developing delivery mechanisms for specific business groups.

10.7.7.3 Home-A-Syst Program

This program is based on the Farm-A-Syst program that was originally developed in Wisconsin. The Farm-A-Syst program is a package of work and fact sheets to help farming homeowners protect ground water and ultimately their drinking water from sources of contamination such as livestock waste management, household waste disposal, silage, pesticide or fertilizer storage and handling, fuel storage, and well construction. Other states, such as Idaho and Washington, have revised the program, and call it Home-A-Syst.

In Idaho, the Natural Resources Conservation Service has organized a Planning Committee to modify the work and fact sheets to be consistent with the state rules and policies. The agencies involved in this committee are:

- Natural Resources Conservation Service;
- Idaho Association of Soil Conservation Districts;
- Soil Conservation Districts;
- Department of Water Resources;
- Division of Environmental Quality;
- South Central District Health Department;
- University of Idaho - Cooperative Extension Service;
- Idaho Department of Agriculture;
- Idaho Water Resources Research Institute;
- Soil Conservation Commission; and
- Farmers Home Administration.

The modified sheets were pilot tested in the Cascade Reservoir Region. Once pilot tested, the materials were revised for use statewide.

Promotion of the project and a strategy for statewide implementation began in January 1996 with the hiring of 15 Americorp members. The hiring of the 15 members gives a major start to Home-A-Syst in Idaho.

10.7.7.4 Education Grant

In June 1993 the EPA awarded a grant to a consortium of organizations, of which the Wellhead Protection Program staff was a participant. The purpose of the project was to develop and pilot test a training program that will actively involve community members in conducting source inventories in wellhead protection areas. The project accomplished the following three objectives:

- Developing a draft training manual for community volunteers;
- Pilot testing the draft manual in Moscow, Idaho; and
- Finalizing the training manual.

This manual, entitled "How to Conduct an Inventory in Your Wellhead Protection Area", is available for use by other communities.

10.7.7.5 Additional Education Assistance

Additional education information and guidance will likely include:

- Reference sources for educational material and
- Descriptions and contacts on local water education projects.

A good example of a local water education project is the storm water stenciling project initiated through the Rathdrum Prairie Aquifer Project. Staff from the Coeur d'Alene Regional Office - IDEQ has organized community or school groups to stencil "Do Not Dump, Drains to Stream" or "Do Not Dump; Drains to Aquifer" messages by storm drains. They have developed a guidance manual and provided training so that other communities may adopt a similar program.

Chapter Eleven

Conclusions

11.0 CONCLUSIONS

This Wellhead Protection Plan describes how Idaho intends to administer a voluntary wellhead protection program for the purpose of preventing contamination of ground water that is used as drinking water. The focus of this program is on public water systems, although the plan recognizes the need to provide guidance and education to non-public water systems. By implementing the Wellhead Protection Program, Idaho will be addressing ground water protection requirements identified under the Safe Drinking Water Act and the Idaho Ground Water Quality Plan. Although development of a state wellhead protection program is driven by federal and state programs, the decision to initiate this program for individual drinking water systems rests with the appropriate local entities such as city and county governments and water purveyors.

The wellhead protection area itself represents the surface and subsurface area surrounding a well through which contaminants are likely to move and reach the well. Delineation of the wellhead protection area is based on ground water flow characteristics which depend on subsurface geologic conditions. The wellhead protection area is to consist of three zones generally representing 3 (Zone I), 6 (Zone II) and 10 (Zone III) year time of travel periods for a contaminant within ground water reaching the well. Zone I is further broken down into Zone IA, which is the required sanitary setback where certain contaminant sources are excluded, and Zone IB which encompasses the remainder of Zone I.

Various levels of complexity can be utilized in developing wellhead area delineations based on available information and resources. The Basic I and Basic II Methods for wellhead area delineations are the simplest methods to use, with the Basic I Method requiring little to no additional data beyond the information available within this plan. The Basic II Method is more accurate than the Basic I Method and should be used when some site specific data are available, but the data, technical expertise, and/or funding are not sufficient to use the Refined Method. The Refined Method represents an even more detailed approach utilizing site specific ground water flow information. This approach is expected to obtain a more accurate wellhead area delineation than either basic method, but will generally require additional resources that may not be available to all communities wishing to implement wellhead protection. The Refined Exception Method is a special case approach where the combined zones (IB, II, and III) of the standard Refined Method are so large as to be unmanageable and the community can demonstrate that they can effectively manage the potential sources of contamination in a smaller wellhead protection area.

Local entity partnerships and public involvement are important implementation components of a wellhead protection program. The delineation of a wellhead protection area will further reveal the importance of these roles because the resulting wellhead area may involve a

mixture of government land and private land under county or city jurisdiction. Coordinated efforts among all potentially affected entities will ensure a comprehensive wellhead protection approach.

Other key program implementation elements include the inventory and management of potential sources of contamination within the delineated wellhead protection area. Local governments often have the authority to manage potential sources of contamination within the portion of the wellhead protection area that is within their jurisdiction. In general, there should be an appropriate level of management throughout wellhead protection areas, with progressively more stringent management of land use and waste discharge closer to the wellhead. Management tools and activities can include regulatory approaches such as zoning ordinances, source prohibitions, and permits; or non-regulatory tools such as purchase of development rights or property, water conservation, and public education and information.

A complete wellhead protection plan will include contingency plans to address the locations and provision of alternate drinking water supplies in the event of loss due to contamination or drought. The use of drinking water MCLs, health advisories, and trends which indicate decreasing water quality are recommended to plan contingency implementation actions.

Wellhead protection planning is also an important consideration for locating new wells. Local governments and water purveyors should cooperate in the effort to plan, site, and protect future drilling sites. Future well sites should be located in areas with as few potential sources of contamination as possible, and the site should be reserved and protected for this specific use.

In Idaho, the Wellhead Protection Program is voluntary for local governments and water suppliers to implement. Local governments and water suppliers will be encouraged, but are not required to develop a local wellhead protection program. It is the intent of IDEQ to assist interested communities in their efforts by providing guidance and technical assistance. IDEQ will make presentations, hold workshops, train appropriate staff, pursue program funding assistance, and coordinate implementation efforts with other agencies and with the Idaho Rural Water Association. IDEQ will certify those local wellhead protection plans which are technically appropriate, substantially meet state guidelines, and address all relevant elements of a wellhead protection program.

Interest in wellhead protection has been growing throughout Idaho and there are several local wellhead protection programs being implemented. This shows the desire of the citizens of Idaho to protect their ground water and the quality of their drinking water supplies. Idaho's Wellhead Protection Program will help guide this effort.

Chapter Twelve

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Chapter Thirteen

Glossary

13.0 GLOSSARY

Alluvial - Pertaining to, or composed of, alluvium, or deposited by a stream or running water.

Alluvium - A general term for clay, silt, and sand, gravel, or similar unconsolidated material deposited during comparatively recent geologic time by a stream or other body of running water as a sorted or semi-sorted sediment in the bed of the stream or on its floodplain or delta, or as a cone or fan at the base of a mountain slope.

Analytical Model - A model that provides approximate or exact solutions to simplified forms of the differential equations for water movement and solute transport. Analytical models can generally be solved with calculators or computers.

Aquifer - A geological formation of permeable saturated material, such as rock, sand, gravel, etc., capable of yielding economically significant quantities of water to wells and springs.

Area of Influence - Area surrounding a pumping or recharging well within which the water table or potentiometric surface has been changed due to the well's pumping or recharge.

Artesian - A condition in an aquifer that causes the water level in a well to rise above the top of the aquifer. If the water level in a well rises above the ground surface, the condition is called flowing artesian.

Artesian Aquifer - An aquifer that demonstrates artesian characteristics.

Attenuation - The process of diminishing contaminant concentrations in ground water, due to filtration, biodegradation, dilution, sorption, volatilization, and other processes.

Bedrock - A general term for the rock that underlies soil or other unconsolidated material.

Best Management Practice (BMP) - A practice or combination of practices determined to be the most effective and practical means of preventing or reducing contaminations to ground water and/or surface water from nonpoint and point sources to achieve water quality goals and protect the beneficial uses of the water.

Capture Zone -The same as Zone of Contribution.

Columbia River Basalts - Includes flood type basalts that are dense, exhibit rude columnar jointing in many places, and are folded and faulted. These basalts may include some rhyolitic and andesitic rock types. Hydraulic conductivity is highly variable; the aquifer may exhibit confined and unconfined conditions (Whitehead & Parliman, October 1979).

Cone of Depression (COD) - A depression in the ground-water table or potentiometric surface that has the shape of an inverted cone and develops around a well from which water is being withdrawn. It defines (in cross-section) the area of influence of a well. Also called pumping cone and cone of drawdown (COD).

Confined Aquifer - An aquifer bounded above and below by confining units of distinctly lower permeability than the aquifer media. An aquifer in which ground water is under pressure significantly greater than atmospheric and its upper limit is the bottom of a bed of distinctly lower hydraulic conductivity than that of the aquifer itself. The confined ground water within the aquifer will generally exhibit artesian characteristics.

Confining Unit - A hydrogeologic unit of relatively impermeable material, bounding one or more aquifers. This is a general term that has replaced aquitard, aquifuge, and aquiclude and is synonymous with confining bed. A body of material of low hydraulic conductivity that is stratigraphically adjacent to one or more aquifers. It may lie above or below the aquifer.

Contaminant - Any chemical, ion, radionuclide, synthetic organic compound, microorganism, waste or other substance which does not occur naturally in ground water or which naturally occurs at a lower concentration.

Contamination - The direct or indirect introduction into ground water of any contaminant caused in whole or in part by human activities.

Criteria, WHPA - Conceptual standards that form the basis for WHPA delineation. WHPA criteria can include distance, drawdown, time of travel, assimilative capacity, and flow boundaries.

Discharge Area - An area in which ground water is discharged to the land surface, surface water, or atmosphere. An area in which there are upward components of hydraulic head in the aquifer. Ground water is flowing toward the surface in a discharge area and may escape as a spring, a seep, stream base flow, or by evaporation and transpiration.

Drawdown - The vertical distance ground-water elevation is lowered, or the amount pressure head is reduced, due to the removal of ground water. It is reflected by the decline in potentiometric surface caused by the withdrawal of water from a hydrogeologic unit or the difference between the static water level and the surface of the cone of depression. This is the same as the lowering of the water table of an unconfined aquifer or the potentiometric surface of a confined aquifer caused by pumping of ground water from wells.

Eastern Snake River Plain Basalts - Includes the basalts of the Snake River Group, the associated sedimentary and pyroclastic interbeds, and the river and lake deposited sediments that were laid down around the southern, eastern, and northern margins of the basalt flows. This flow system is considered one of the most prolific in the world. (Graham & Campbell, August 1981)

Effective Porosity (n_e) - The amount of interconnected pore space through which fluids can pass, expressed as a percent of bulk volume. Part of the total porosity will be occupied by static fluid being held to the mineral surface by surface tension, so effective porosity will be less than total porosity.

Flow Model - A digital computer model that calculates a hydraulic head field for the modeling domain using numerical methods to arrive at an approximate solution to the differential equation of ground-water flow.

Fracture - A general term for any break in a rock, which includes cracks, joints and faults.

GPD - Gallons per day, a commonly used measure of the withdrawal rate of a well.

Ground Water Any water of the state which occurs beneath the surface of the earth in a saturated geologic formation of rock or soil.

Ground Water, Confined - Ground water within a confined aquifer under artesian conditions.

Ground- Water Flow - The movement of ground water through openings in sediment and rock that occurs in the zone of saturation.

Ground- Water Model - A simplified conceptual or mathematical image of a ground-water system, describing the feature essential to the purpose for which the model was

developed and including various assumptions pertinent to the system. Mathematical ground-water models can include numerical and analytical models.

Ground Water, Unconfined - Ground water under conditions where the upper surface of the zone of saturation forms a water table under atmospheric pressure.

Hydraulic Conductivity (K) - Proportionality constant relating hydraulic gradient to specific discharge, which for an isotropic medium and homogeneous fluid, equals the volume of water at the existing kinematic viscosity that will move in unit time under a unit hydraulic gradient through a unit area measured at right angles to the direction of flow. The rate of flow of water in gallons per day through a cross section of one square foot under a unit hydraulic gradient, at the prevailing temperature (gpd/ft^2). In the Standard International System, the units are $m^3/day/m^2$ or m/day. A coefficient of proportionality describing the rate at which water can move through a permeable medium. The density and kinematic viscosity of the water must be considered in determining hydraulic conductivity.

Hydraulic Gradient (I) - Slope of a water table or potentiometric surface. More specifically, change in static head per unit of distance in a given direction, generally the direction of the maximum rate of decrease in head. The rate of change in total head per unit of distance of flow in a given direction. The change in total head with a change in distance in a given direction. The direction is that which yields a maximum rate of decrease in head. The difference in hydraulic heads ($h_1 - h_2$), divided by the distance (L) along the flowpath. $i = (h_1 - h_2) / L$

Hydrogeologic - Those factors that deal with subsurface waters and related geologic aspects of surface waters.

Hydrogeologic Parameters - Numerical parameters that describe the hydrogeologic characteristics of an aquifer such as porosity, permeability, and transmissivity.

Hydrogeologic Unit - Any soil or rock unit or zone that because of its hydraulic properties has a distinct influence on the storage or movement of ground water.

Infiltration Rate - Rate at which soil or rock under specified conditions absorbs falling rain, melting snow, or other forms of surface water; expressed in depth of water per unit time.

Limestone - A sedimentary rock consisting chiefly of calcium carbonate, primarily in the form of the mineral calcite.

Maximum Contaminant Level (MCL) - Maximum permissible level of a contaminant in water that is delivered to the users of a public water supply system. MCL is defined more explicitly in Safe Drinking Water Act regulations (40 CFR Section 141.2).

MGD - Million gallons per day, a commonly used measure of the withdrawal rate of large wells.

Minor Aquifers - Includes a general classification for all other aquifers that do not fall in the major aquifer categories. Primary aquifers in this category include intrusive granitic rocks and related rocks of comparable age of which the Idaho Batholith of central Idaho dominate. Also included are well indurated sedimentary and metamorphic rocks that have been folded, faulted, and intruded by granitic rocks. These rocks tend to crop out in the mountainous regions and may include younger sedimentary rocks (Whitehead & Parliman, October 1979).

Mixed Volcanic and Sedimentary Rocks; Primarily Sedimentary Rocks - Includes the Idaho Group rocks commonly found in the deeper (>100-200 feet) wells of the Boise Valley. The Idaho Group rocks are characterized by unconsolidated to poorly consolidated clay, silt, sand, volcanic ash, diatomite, fresh water limestone and conglomerate. Basalt interbeds occur in some areas. The Idaho Group sediments are overlain by unconsolidated silts, sands and gravels (typically called Terrace Gravel deposits). Thicknesses may reach 5000 feet near the Idaho-Oregon state line.

Mixed Volcanic and Sedimentary Rocks; Primarily Volcanic Rocks - Includes the Bruneau, Banbury and Glenns Ferry Formations. The Bruneau and Banbury Formations are characterized by thick basalt flows, commonly interbedded with thin, fine grained sedimentary layers. Total basalt thickness exceeds 1000 feet in some localities.

The Glenns Ferry Formation is characterized by poorly consolidated detrital material and minor flows of olivine basalt. Silt, clay, and sand beds are common. Total thickness is about 2000 feet.

Monitoring Waiver - A temporary reduction in sampling requirements for a particular contaminant. Even after a waiver is received, some monitoring at a reduced frequency will usually be required. Waivers must be applied for and granted in writing.

Nonpoint Source - A potential source of contamination having diffuse or multiple discharges of contaminants that are spread over a large area.

Perched Ground Water - Unconfined ground water separated from an underlying main body of ground water by an unsaturated zone.

Percolation - Downward movement of water through the unsaturated zone; also defined as the downward flow of water in saturated or nearly saturated porous media at hydraulic gradients of 1.0 or less. The act of water seeping or filtering through the soil without a definite channel.

Permeability - Ability of a porous medium to transmit fluids under a hydraulic gradient. The property or capacity of a porous rock, sediment, or soil for transmitting a fluid; it is a measure of the relative ease of fluid flow under unequal pressure.

Point Source - A potential source of ground water contamination which is individually identifiable in terms of release and zone of impact in the aquifer.

Porosity or Total Porosity (n) - The volume of void spaces in rock or sediment divided by the total volume of the porous medium. Porosity is usually expressed as a decimal fraction or a percent.

Potable Water - Suitable for human consumption as drinking water.

Potentiometric Surface - A surface that represents the level to which water would rise in tightly cased wells. If the head varies significantly with depth in the aquifer, then there may be more than one potentiometric surface. The water table is equal to the potentiometric surface for an unconfined aquifer.

Public Water Supply System - System for provision to the public of piped water for human consumption, if such system has at least 15 service connections or regularly serves at least 25 individuals daily for at least 60 days out of the year. The term includes any collection, treatment, storage, and distribution facilities under control of the operator of such system and used primarily in connection with the system, and any collection or pretreatment storage facilities not under such control that are used primarily in connection with the system.

Radius of Influence - The radial distance from the center of a well bore to the point where there is no lowering of the water table or potentiometric surface (the edge of its cone of depression).

Rathdrum Prairie Aquifer - Includes glaciofluvial deposits that extend from Lake Pend Oreille to the Idaho-Washington border. The deposits include fine to coarse sands and gravels and are relatively free of fine-grained materials except near land surface. The saturated thickness of the aquifer is about 280 feet near the state border. The aquifer is thought to overlie the fine grained, semi-consolidated sediments of the Latah Formation (Graham & Campbell, August 1981).

Recharge (r) - The addition of water to the zone of saturation; also, the amount of water added. Can be expressed as a rate (i.e., in/yr) or a volume.

Recharge Area - An area in which water infiltrates into the soil or geological formation from sources such as precipitation, irrigation practices and seepage from creeks, streams or lakes, and percolates to one or more aquifers.

Recharge Boundary - An aquifer system boundary that adds water to the aquifer. Streams and lakes are typical recharge boundaries.

Saturated Zone - Portion of the subsurface environment in which all voids are ideally filled with water under pressure greater than atmospheric. The water table is the top of the saturated zone in an unconfined aquifer. It is also called the phreatic zone.

Semiconfined Aquifer - An aquifer that has a leaky confining unit and displays characteristics of a confined aquifer.

Specific Storage - The volume of water that a unit volume of aquifer releases from storage under a unit decline in hydraulic head.

Specific Yield - The ratio of the volume of water that a given mass of saturated rock or soil will yield by gravity drainage to the volume of that mass. This ratio is stated as a percentage.

Spring - Discrete discharge area where ground water flows naturally from rock or soil onto the land surface or into a surface-water body.

Static Water Level - The level of water in a well.

Storativity (S) - A dimensionless term representing the volume of water an aquifer releases from or takes into storage per unit surface area of the aquifer per unit change in head. It is equal to the product of specific storage and aquifer thickness. In an

unconfined aquifer, the storativity is equivalent to the specific yield. Also called storage coefficient.

Time of Travel (TOT) - The time required for a contaminant to move in the saturated zone from a specific point to a well.

Transmissivity (T) - Rate at which water of the prevailing kinematic viscosity is transmitted through a unit width of the aquifer under a unit hydraulic gradient. It is equal to an integration of the hydraulic conductivities across the saturated part of the aquifer perpendicular to the flow paths and is therefore the rate at which water is transmitted through a unit width of an aquifer under a unit hydraulic gradient. Transmissivity values are given in gallons per day through a vertical section of an aquifer 1 foot wide and extending the full saturated height of an aquifer under a hydraulic gradient of one in the English Engineering system; in the Standard International System, transmissivity is given in cubic meters per day through a vertical section of an aquifer 1 meter wide and extending the full saturated height of an aquifer under a hydraulic gradient of one. It is a function of properties of the liquid, the porous media and the thickness of the porous media.

Unconfined Aquifer - An aquifer in which there is no confining bed between the zone of saturation and the land surface. The upper surface of the saturated water body is called the water table, where the water pressure is atmospheric.

Unconsolidated Alluvium - Includes alluvium, glacial outwash, talus, terrace gravel, and lake bed and windblown deposits. The deposits include clay, silt, sand, gravel, and boulders which may be loose to well compacted, unbedded to well bedded. Sandy and gravelly alluvium is an important aquifer whereas lake bed sediments yield low amounts of water. Terrace gravel deposits can yield moderate to large amounts of water but in many areas the deposits occur above the water table (Whitehead & Parliman, October 1979).

Unconsolidated Aquifer - An aquifer made up of loose material, such as sand or gravel.

Unsaturated Flow - Movement of water in a porous medium in which the pore spaces are not filled with water.

Unsaturated Zone - Zone or layer of earth in which not all of the interconnected pore spaces of rock or soil are filled with water. The pore spaces will contain some water, as well as air and other gases. This is also known as the vadose zone.

Vadose Zone - See unsaturated zone.

Water Table - The surface on which the fluid pressure in the pores of a porous medium is exactly atmospheric. The upper surface of an unconfined aquifer.

Wellfield - An area containing two or more wells with overlapping zones of contribution that supply a public water supply system.

Wellhead - The physical structure, facility, or device at the land surface from or through which ground water flows or is pumped from subsurface water-bearing formations.

Wellhead Protection Area (WHPA) - The surface and subsurface area surrounding a water well or wellfield, supplying a public water system, through which contaminants are reasonably likely to move toward and reach such water well or wellfield.

Well Yield - The rate of discharge of water from a well, measured in gallons per minute or cubic meters per day.

WHPA - See Wellhead Protection Area.

Zone of Contribution (ZOC) - The area surrounding a pumping well that encompasses all areas or features that supply ground-water recharge to the well.

Zone of Influence (ZOI) - The area surrounding a pumping well within which the water table or potentiometric surfaces have been changed due to ground-water withdrawal.

Zone of Transport (ZOT) - The area surrounding a pumping well through which a contaminant may travel and reach the well.

Appendices

APPENDIX A 1986 AMENDMENTS TO THE SAFE DRINKING WATER ACT: SECTION 1428

STATE PROGRAMS TO ESTABLISH WELLHEAD PROTECTION AREAS

A. STATE PROGRAMS The Governor or Governor's designee of each state shall, within 3 years of the date of enactment of the Safe Drinking Water Act Amendments of 1986, adopt and submit to the Administrator a state program to protect wellhead areas within their jurisdiction from contaminants which may have any adverse affects on the health of persons. Each state program under this section shall, at a minimum--

1. Specify the duties of state agencies, local governmental entities, and public waste supply systems with respect to the development and implementation of programs required by this section;
2. For each wellhead, determine the wellhead protection area as defined in subsection (E) based on all reasonably available hydrogeologic information on ground water flow, recharge and discharge and other information the state deems necessary to adequately determine the wellhead protection area;
3. Identify within each wellhead protection area all potential anthropogenic sources of contaminants which may have any adverse effect on the health of persons;
4. Describe a program that contains, as appropriate, technical assistance, financial assistance, implementation of control measures, education, training, and demonstration contaminants;
5. Include contingency plans for the location and provision of alternate drinking water supplies for each public water system in the event of well or wellfield contamination by such contaminants; and
6. Include a requirement that consideration be given to all potential sources of such contaminants within the expected wellhead area of a new water well which serves a public water supply system.

B. PUBLIC PARTICIPATION To the maximum extent possible, each state shall establish procedures, including but not limited to the establishment of technical and citizens advisory committees, to encourage the public to participate in developing the protection program for wellhead areas. Such procedures shall include notice and opportunity for public hearing on the State program before it is submitted to the Administrator.

C. DISAPPROVAL

1. **IN GENERAL** If, in the judgement of the Administrator, a State program (or portion thereof, including the definition of a wellhead protection area) is not adequate to protect public water systems as required by this section, the Administrator shall disapprove such program (or portion thereof). A State program developed pursuant to subsection (A) shall be deemed to be adequate unless the Administrator determines, within 9 months of the receipt of a State program, that such program (or portion thereof) is inadequate for the purpose of protecting public water systems as required by this section from contaminants that may have any adverse effect on the health of persons. If the Administrator determines that a proposed State program (or any portion thereof) is inadequate, the Administrator shall submit a written statement of the reasons for such determination to the Governor of the State.
2. **MODIFICATION AND RESUBMISSION** Within 6 months after receipt of the Administrator's written notice under paragraph (1) that any proposed State program (or portion thereof) is inadequate, the Governor or Governor's designee, shall modify the program based upon the recommendations of the Administrator and resubmit the modified program to the Administrator.

D. FEDERAL ASSISTANCE After the date 3 years after the enactment of this section, no State shall receive funds authorized to be appropriated under this section except for the purpose of implementing the program and requirements of paragraphs (4) and (6) of subsection (A).

E. DEFINITION OF WELLHEAD PROTECTION AREA As used in this section, the term wellhead protection area means the surface and subsurface area surrounding a water well or wellfield, supplying a public water system, through which contaminants are reasonably likely to move toward and reach such water well or wellfield. The extent of a wellhead protection area, within a State, necessary to provide protection from contaminants which may have any adverse effect on the health of persons is to be determined by the State in the program submitted under subsection (A). Not later than one year after the enactment of the Safe Drinking Water Act Amendments of 1986, the Administrator shall issue technical guidance which States may use in making such determinations. Such guidance may reflect such factors as the radius of influence around a well or wellfield, the depth of drawdown of the water tables by such well or wellfield at any given point, the time or rate of travel of various contaminants in various hydrologic conditions, distance from the well or wellfield, or other factors affecting the likelihood of contaminants reaching the well or wellfield, taking into account available

engineering pump tests or comparable data, field reconnaissance, topographic information, and the geology of the formation in which the well or wellfield is located.

F. PROHIBITIONS

1. **ACTIVITIES UNDER OTHER LAWS** No funds authorized to be appropriated under this section may be used to support activities authorized by the Federal Water Pollution Control Act, the Solid Waste Disposal Act, the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, or other sections of this Act.
2. **INDIVIDUAL SOURCES** No funds authorized to be appropriated under this section may be used to bring individual sources of contamination into compliance.

G. IMPLEMENTATION Each State shall make every reasonable effort to implement the State wellhead area protection program under this section within 2 years of submitting the program to the Administrator, each State shall submit to the Administrator a biennial status report describing the States progress in implementing the program. Such report shall include amendments to the State program for water wells sited during the biennial period.

H. FEDERAL AGENCIES Each department, agency, and instrumentality of the executive, legislative, and judicial branches of the federal government having jurisdiction over any potential source of contaminants identified by a State program pursuant to the provisions of subsection (A)(3) shall be subject to and comply with all requirements of the State program developed according to subsection (A)(4) applicable to such potential source of contaminants, both substantive and procedural, in the same manner, and to the same extent, as any other person is subject to such requirements, including payment of reasonable charges and fees. The President may exempt any potential source under the jurisdiction of any department, agency, or instrumentality in the executive branch if the President determines it to be in the paramount interest of the United States to do so. No such exemption shall be granted due to the lack of an appropriation unless the President shall have specifically requested such appropriation as part of the budgetary process and the Congress shall have failed to make available such requested appropriations.

I. ADDITIONAL REQUIREMENT

1. **IN GENERAL** In addition to the provisions of subsection (A) of this section, States in which there are more than 2,500 active wells at which annular injection is used

as of January 1, 1986, shall include in their State program a certification that a State program exists and is being adequately enforced that provides protection from contaminants which may have any adverse effect on the health of persons and which are associated with the annular injection or surface disposal of brines associated with oil and gas production.

2. **DEFINITION** For purposes of this subsection, the term annular injection means the reinjection of brines associated with the production of oil or gas between the production and surface casings of a conventional oil or gas producing well.
3. **REVIEW** The Administrator shall conduct a review of each program certified under this section.
4. **DISAPPROVAL** If a State fails to include the certification required by this subsection or if in the judgement of the Administrator the State program certified under this subjection is not being adequately enforced, the Administrator shall disapprove the State program submitted under subsection (A) of this section.

J. **COORDINATION WITH OTHER LAWS** Nothing in this section shall authorize or require any department, agency, or other instrumentality of the federal government or State or local government to apportion, allocate or otherwise regulate the withdrawal or beneficial use of ground or surface waters, so as to abrogate or modify any existing rights to water established pursuant to state or federal law, including interstate compacts.

K. **AUTHORIZATION OF APPROPRIATIONS** Unless the state program is disapproved under this section, the Administrator shall make grants to the state for not less than 50 or more than 90 percent of the costs incurred by a state (as determined by the Administrator) in developing and implementing each state program under this section. For purposes of making such grants there is authorized to be appropriated not more than the following amounts:

Fiscal year:	Amount
1987	$20,000,000
1988	20,000,000
1989	35,000,000
1990	35,000,000
1991	35,000,000

APPENDIX B IDAHO GROUND WATER PROTECTION ACT 1989

THE STATE OF IDAHO

CENTENNIAL LEGISLATURE FIRST REGULAR SESSION -1989

IN THE SENATE

SENATE BILL 1269

BY STATE AFFAIRS COMMITTEE

RELATING TO GROUND WATER QUALITY; AMENDING SECTION 39-102, IDAHO CODE, TO PROVIDE LEGISLATIVE INTENT REGARDING GROUND WATER QUALITY; AMENDING CHAPTER 1, TITLE 39, IDAHO CODE, BY THE ADDITION OF NEW SECTIONS 39-120, 39-121, 39-122, 39-123, 39-124, 39-125, 39-126 AND 39-127, IDAHO CODE, TO DESIGNATE THE DEPARTMENT OF HEALTH AND WELFARE AS THE PRIMARY AGENT TO COORDINATE AND ADMINISTER GROUND WATER QUALITY PROTECTION PROGRAMS FOR THE STATE, TO PROVIDE THE SCOPE AND DUTIES OF THE GROUND WATER QUALITY COUNCIL AND CERTAIN STATE AGENCIES, TO DEFINE TERMS, TO CREATE THE GROUND WATER QUALITY COUNCIL, TO PROVIDE FOR COMPLETION OF THE GROUND WATER QUALITY PLAN, TO PROVIDE FOR ADOPTION, AMENDMENT OR REJECTION OF THE PLAN BY THE LEGISLATURE, TO PROVIDE FOR A CHAIRMAN AND QUORUM OF THE GROUND WATER QUALITY COUNCIL, TO PROVIDE THE DUTIES OF STATE AND LOCAL GOVERNMENTS REGARDING THE GROUND WATER QUALITY PLAN, AND TO PROVIDE FOR LIABILITY FOR APPLICATION OF A PESTICIDE OR FERTILIZER PRODUCT; AMENDING CHAPTER 65, TITLE 67, IDAHO CODE, BY THE ADDITION OF A NEW SECTION 67-6537, IDAHO CODE, TO PROVIDE FOR LOCAL GOVERNMENT'S COMPREHENSIVE PLAN TO GROUND WATER QUALITY; AND PROVIDING A SHORT TITLE.

Be It Enacted by the Legislature of the State of Idaho:

SECTION 1. That Section 39-102, Idaho Code, be, and the same is hereby amended to read as follows:

39-102. STATE POLICY ON ENVIRONMENTAL PROTECTION. 1. It is hereby recognized by the legislature that the protection of the environment and the promotion of personal health are vital concerns and are therefore of great importance to the future welfare of this state. It is therefore declared to be the policy of the state to provide for the protection of the environment and the promotion of personal health and to thereby protect and promote the health, safety and general welfare of the people of this state.

2. The goal of the legislature in enacting the ground water quality protection act of 1989 shall be to maintain the existing high quality of the state's ground water and to satisfy existing and projected future beneficial uses including drinking water, agricultural, industrial and aquacultural water supplies. All ground water shall be protected as a valuable public resource against unreasonable contamination or deterioration. The quality of degraded ground water shall be restored where feasible and appropriate to support identified beneficial uses.

3. In enacting this law, the legislature intends to prevent contamination of ground water from point and nonpoint sources of contamination to the maximum extent practical. In attaining the goals enumerated in subsections 1 and 2 of the section, the legislature wishes to enumerate the following ground water quality protection goals:

a. It is the policy of the state to prevent contamination of ground water from any source to the maximum extent practical.

b. The discovery of any contamination that poses a threat to existing or projected future beneficial uses of ground water shall require appropriate actions to prevent fur-

ther contamination. These actions may consist of investigation and evaluation or enforcement actions if necessary to stop further contamination or clean up existing contamination as required under the environmental protection and health act.

c. All persons in the state should conduct their activities so as to prevent the nonregulated release of contaminants into ground water.

d. Education of the citizens of the state is necessary to preserve and restore ground water quality.

SECTION 2. That Chapter 1, Title 39, Idaho Code be, and the same is hereby amended by the addition thereto of NEW SECTIONS, to be known and designated as Sections 39-120, 39-121, 39-122, 39-123, 39-124, 39-125, 39-126, and 39-127, Idaho Code, and to read as follows:

39-120. DEPARTMENT OF HEALTH AND WELFARE PRIMARY ADMINISTRATIVE AGENCY - AGENCY RESPONSIBILITIES. 1. The department of health and welfare is designated as the primary agency to coordinate and administer ground water quality protection programs for the state.

2. Recognizing that the department of water resources has the responsibility to maintain the natural resource geographic information system for the state and is the collector of baseline data for the state's water resources, that the department of health and welfare has the responsibility for collecting and monitoring data for water quality management purposes and that the department of agriculture is responsible for regulating the use of pesticides and fertilizers and for licensing applicators, the department of health and welfare, the department of water resources and the department of agriculture in coordination with the ground water quality council shall:

a. Make plans for development and administration of a comprehensive ground water quality monitoring network, including point of use, point of contamination and problem assessment monitoring sites across the state and the assessment of ambient ground water quality utilizing, the greatest degree possible, collection and coordination of existing data sources.

b. Prepare and annual report during the life of the council detailing the number and concentration of contaminants detected in ground water by location.

c. Establish a system or systems within state departments ad political subdivisions of the state for collecting, evaluating and disseminating ground water quality data and information.

d. Develop and maintain a natural resource geographic information system and comprehensive water resource data system. The system shall be accessible to the public.

3. The responsible state departments or boards, after consultation with the ground water quality council, should adopt rules which specify the general standards for determining actions necessary to prevent ground water contamination and cleanup actions necessary to meet the goals of the state.

4. The board of health and welfare may adopt, by rule, after consultation with the ground water quality council, ambient ground water quality standards for contaminants for which the administrator of the United States environmental protection agency has established drinking water maxim contaminant levels. The board, after consultation with the ground water quality council, may adopt by rule such ground water quality standards for contaminants for which the administrator has not established drinking water maximum contaminant levels. However, the existence of such standards, or the lack of them, should not be construed or utilized in derogation of the ground water quality protection goals and protection policies of the state.

5. The departments of health and welfare, water resources and agriculture should take actions necessary to promote and assure public confidence an public awareness of ground water quality protection. In pursuing this goal, the departments and public health districts should make public the results of investigations concerning ground water quality subject to the restrictions contained in section 39-111, Idaho Code.

39-121.DEFINITIONS. As used in section 39-102, Idaho Code, and in sections 39-120 through 39-127, Idaho Code:

1. "Cleanup" means removal, treatment or isolation of a contaminant form ground water through the directed efforts of humans or the removal or treatment of a contamiant in ground water through management practice or the construction of barriers, trenches and other similar facilities for prevention of contamination, as well as the use of natural processes such as ground water recharge, natural decay and chemical or biological decomposition.

2. "Contaminant" means any chemical, ion, radionuclide, synthetic organic compound, microorganism, waste or other substance which does not occur naturally in ground water or which naturally occurs at a lower concentration.

3. "Contamination" means the direct or indirect introduction into ground water of any contaminant caused in whole or in part by human activities.

4. "Council" or "ground water quality council" means the ground water quality council created in section 39-122, Idaho Code.

5. "Ground water" means any water of the state which occurs beneath the surface of the earth in a saturated geological formation of rock or soil.

39-122. GROUND WATER QUALITY COUNCIL CREATED. 1. There is hereby created the ground water quality council. Membership on the council shall consist of the following:

a. The director of the department of health and welfare or his designee.
b. The director of the department of water resources or his designee.
c. The director of the department of agriculture or his designee.
d. A member of a district board of health appointed by the governor.
e. One (1) representative of the mining industry appointed by the governor.
f. One (1) representative of the agricultural industry or the feedlot or dairy industry appointed by the governor.
g. One (1) representative of the soil conservation districts or the soil conservation commission appointed by the governor.
h. One (1) representative of an environmental group or organization appointed by the governor.
I. One (1) representative of the general public appointed by the governor.
j. One (1) representative of the petroleum industry appointed by the governor.
k. One (1) representative of the agricultural chemical manufacturing or distribution industry appointed by the governor.
l. One (1) representative of city government appointed by the governor.
m. One (1) representative of the food processing industry appointed by the governor.
n. One (1) representative of the manufacturing industry which generates hazardous waste appointed by the governor.
o. One (1) representative of the hazardous waste treatment, storage or disposal industry appointed by the governor.
p. One (1) representative of county government appointed by the governor.
q. One (1) representative of a conservation organization appointed by the governor.
r. Additionally, the governor shall appoint representatives of the university of Idaho college of mines, the university of Idaho water resources research institute, the United States environmental protection agency, the Idaho national engineering laboratory and the United States geological survey to serve as ex officio nonvoting members of the ground water quality council.

2. Appointees to the ground water quality council shall serve at the pleasure of the governor.

3. Members of the ground water quality council who are not state employees shall be entitled to receive compensation as provided in section 59-509(b), Idaho Code.

4. The council by majority vote shall establish operating procedures. The operating procedures shall be made available for public review.

5. In the conduct of its business, the council shall solicit the advice of, and consult periodically with the cities, counties, private entities and persons within the state for the purpose of receiving information that may be helpful in the preparation of the ground water quality protection plan.

6. Following final approval of the ground water quality protection plan by the legislature, the council shall exist for up to two (2) years to see the progress made in implementing the provisions of the plan. If not reauthorized by the legislature following the two (2) years after the legislature's adoption of the plan, the council shall disband.

39-123. COMPLETION OF GROUND WATER QUALITY PLAN. 1. Not later than June, 1, 1990, the ground water quality council shall prepare a ground water quality plan which shall comply with the direction enumerated in sections 39-102 and 39-120, Idaho Code.

2. The plan shall:

a. Describe the state's overall approach to protecting its ground water.

b. Take into account existing beneficial uses and existing ground water quality.

c. Identify existing authorities and programs to protect ground water quality.

d. Propose legislative, administrative and economic mechanisms to protect ground water quality.

e. Review and make recommendations on plans for development and administration of a comprehensive ground water monitoring network, including point of use, point of contamination and problem assessment monitoring sites across the state and the assessment of ambient ground water quality utilizing, to the greatest extent possible, collection and coordination of existing data sources.

f. Include programs to promote and assure public awareness of ground water protection.

Upon completion of the plan, the council shall publish a notice after giving twenty (20) days' notice as provided in section 60-109, Idaho Code, in one (1) or more newspapers and shall issue a statewide news release announcing the availability of the plan for inspection by interested persons. The announcement shall indicate where and how the plan may be obtained or reviewed and shall indicate the not less than three (3) public hearings shall be conducted at various locations in the state before formal adoption. The first public hearing shall not be held until forty-five (45) days have elapsed from the date of the notice announcing the availability of the plan. After public hearings, the council shall prepare a written summary of the comments received, provide comments on the major concerns raised, make amendments to the plan as necessary and shall formally adopt the plan, and shall submit the plan to the legislature at the first regular session of the legislature following adoption of the plan.

39-124. AMENDMENT OR REJECTION OF PLAN. The legislature shall amend, adopt or reject the plan by passage of a statute at the regular legislative session when it receives the plan. If the plan is amended or rejected, the legislature shall indicate the reasons for amendment or rejection by passage of a statute and return the plan to the ground water quality council. After action by the legislature, the plan shall have the force and effect of law.

39-125. CHAIRMAN-QUORUM. The chairman of the council shall be the director of the department of health and welfare or his designee. A majority of members shall constitute a quorum for the transaction of business. In the event a vacancy occurs on the council, a replacement shall be appointed in the same manner as an original member. The department of health and welfare shall pay the expenses and per diem of all members of the ground water quality council who are not state employees.

39-126. DUTIES OF STATE AND LOCAL UNITS OF GOVERNMENT. 1. All state agencies shall incorporate the adopted ground water quality protection plan in the administration of their programs and shall have such additional authority to promulgate rules and regulations to protect ground water quality as necessary to administer such

programs which shall be in conformity with the ground water quality protection plan. Cities, counties and other political subdivisions of the state shall incorporate the ground water quality protection plan in their programs and are also authorized and encouraged to implement ground water quality protection policies within their respective jurisdictions, provided that the implementation is consistent with and not preempted by the laws of the state, the ground water quality protection plan and any rules or regulations promulgated thereunder. All state agencies, cities, counties and other political subdivisions shall cooperate with the ground water quality council, the department of health and welfare, the department of agriculture and the department of water resources in disseminating public information and education materials concerning the use and protection of ground water quality, in collecting ground water quality management data, and in conducting research on technologies to prevent or remedy contamination of ground water.

2. Notwithstanding any other provision of law to the contrary, except as provided in subsection 3 of this section, whenever a state agency, city, county or other political subdivision of the state issues a permit or license which deals with the environment, the entity issuing the permit or license shall take into account the effect the permitted or licensed activity will have on the ground water quality of the state and it may attach conditions to the permit or license in order to mitigate potential or actual adverse effects from the permitted or licensed activity on the ground water quality of the state. Nothing contained in this section shall authorize a state agency, city, county or other political subdivision of the state to issue or require a permit or license which it is not otherwise allowed by law to issue or required.

3. Except as otherwise provided by the ground water quality protection plan, if a permit or license which deals with the environment is required to be obtained from a state agency and that agency considers the effect of the permitted or licensed activity on ground water quality, after notice to other units of government which may otherwise have regulatory authority over the activity which is the subject of the permit or license, a city, county or other political subdivision of the state shall not prohibit, limit or otherwise condition the rights of the permittee or licensee under the permit or license on account of the effect the permitted or licensed activity may have on ground water quality.

Nothing contained in this section shall be deemed to permit cities, counties or other political subdivisions of the state to regulate ground water quality with respect to any activity for which another statute or other statutes may have expressly or impliedly preempted such local ground water quality regulation.

39-127. APPLICATION OF FERTILIZERS AND PESTICIDES. No person shall be liable for ground water contamination resulting from the application of fertilizers or pesticides if the person applies a fertilizer according to generally accepted agronomic practices, or applies a pesticide product registered under the federal insecticide, fungicide, rodenticide act according to label requirements, including precautionary statements, of the U.S. environmental protection agency, and such application of the pesticide or fertilizer is otherwise done with the proper equipment required by law, is without negligence and is in accordance with state laws.

SECTION 3. That Chapter 65, Title 67, Idaho Code, be, and the same is hereby amended by the addition thereto of a NEW SECTION, to be known and designated as Section 67-6537, Idaho Code, and to read as follows:

67-6537. APPLICATION TO GROUND WATER. When considering amending, repealing or adopting a comprehensive plan, the local governing board shall consider the effect the proposed amendment, repeal or adoption of the comprehensive plan would have on the quality of ground water in the area.

SECTION 4. SHORT TITLE. This act may be known and cited as the "Ground Water Quality Protection act of 1989."

LEGISLATURE OF THE STATE OF IDAHO

FIFTY-FIRST LEGISLATURE SECOND REGULAR SESSION-1992

IN THE SENATE

SENATE BILL NO. 1321

BY RESOURCES AND ENVIRONMENT COMMITTEE

AN ACT

RELATING TO THE GROUND WATER QUALITY PLAN; PROVIDING LEGISLATIVE ADOPTION OF THE IDAHO GROUND WATER QUALITY PLAN.

Be It Enacted by the Legislature of the State of Idaho:

SECTION 1. Pursuant to the requirements of Section 39-124, Idaho Code, the Legislature of the State of Idaho does hereby adopt the Idaho Ground Water Quality Plan finally adopted by the Ground Water Quality Council on November 14, 1991, as provided in Section 39-123, Idaho Code.

APPENDIX C MEMBERS OF THE WELLHEAD PROTECTION WORK GROUP, TECHNICAL TASK FORCE, AND OTHER PARTICIPANTS

WELLHEAD PROTECTION WORKGROUP
*WELLHEAD PROTECTION TECHNICAL TASK FORCE

LIST OF MEMBERS	REPRESENTING
Dan Brown*/Jon Bowling*	United Water, Idaho, Inc. (Formally Boise Water Corporation); Boise, Idaho
Lyle Briggs*/RichardCummings	Garden City Public Works; Garden City, Idaho
Sherl Chapman*	Idaho Water Users Association, Inc.; Boise, Idaho
Catherine Chertudi*	Boise City Public Works; Boise, Idaho
Darrel Clapp*	Idaho Rural Water Association; Weiser, Idaho
Marc Eesley	Idaho Association of Cities; Boise, Idaho
Nancy Johansen	Latah County; Moscow, Idaho
Mark Koffer*	Idaho Building Contractors Association/ Walker Water Systems; Twin Falls, Idaho
Mark Lowe	District Health Department; Pocatello, Idaho
Rick Mallory	IDEQ, Drinking Water Program; Boise, Idaho
Ken Neely*	IDWR, Boise,Idaho
John Sutherland	IDEQ, Rathdrum Prairie Aquifer Project; Coeur d'Alene, Idaho
Jim Rush	League of Women Voters; Idaho Falls, Idaho
Dave Tomten	EPA; Boise, Idaho
Gerry Winter*	IDEQ; Boise, Idaho

Spencer Wood*	Boise State University; Boise, Idaho

OTHER PARTICIPANTS

Barbara Barber	City Councilwoman; Weiser, Idaho
Charles Berenbrock	USGS; Boise, Idaho
John Bokor	Idaho Rural Water Association; Donnelly, Idaho
Nancy Bowser	IDEQ; Boise, Idaho
Susie Budge	Idaho Council on Industry and Environment; Boise, Idaho
Tom Callmeyer	Chen Northern; Boise, Idaho
Marc Eesley	Ada County Association of Realtors
Wayne Faude	Soil Conservation Commission; Boise, Idaho
Jim Felton	Idaho Rural Water Association; Lewiston, Idaho
Jonathon Henning	Boise City Planning and Zoning; Boise, Idaho
Lee Holstine	Soil Conservation Commission; Boise, Idaho
Paul Jehn	IDEQ; Boise, Idaho
Joseph Koon	City of Twin Falls; Twin Falls, Idaho
Monty Marchus	IDEQ; Boise, Idaho
Dick Martindale	District Health Department; Coeur d'Alene, Idaho
John McLeod	IDWR; Boise,Idaho
Kirk Miller	EnviroSearch; Boise, Idaho
Roy Mink	Idaho Water Resource Research Institute; Moscow, Idaho

John Moeller	Brown and Caldwell; Boise, Idaho
Roger Noble	CH2M Hill; Boise, Idaho
Brian Painter	IDEQ; Coeur d'Alene, Idaho
Don Payton	City of Cascade; Cascade, Idaho
Daniel Picard	Nez Perce Tribe; Lapwai, Idaho
Mary Price	Nez Perce Tribe; Lapwai, Idaho
Dick Rogers	IDEQ; Boise, Idaho
Marilyn Shinn	University of Idaho, Cooperative Agricultural Extension; Boise, Idaho
Jim Simpson	City of Kuna; Kuna, Idaho
Gary Slette	Rosholt, Robertson and Tucker; Twin Falls, Idaho
Mark Slifka	IDWR; Boise, Idaho
Dennis Smith	CH2M Hill; Boise, Idaho
Mark Tanner	City of Roberts; Roberts, Idaho
Larry Thomsen	City of Pocatello; Pocatello, Idaho
Roger Turner	Shoshone-Bannock Tribes; Ft. Hall,Idaho
John Welhan	Idaho Geologic Survey; Pocatello, Idaho
Dan Whitney	Idaho Department of Agriculture; Boise, Idaho

OFFICE OF THE GOVERNOR
STATE CAPITOL
BOISE 83720-1000

CECIL D. ANDRUS
GOVERNOR

(208) 334-2100

March 2, 1987

Mr. Lee M. Thomas, Administrator
U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, DC 20460

Dear Mr. Thomas:

I am designating the Idaho Department of Health and Welfare, Division of Environment (IDHW-DOE), Water Quality Bureau, as the lead agency for developing Idaho's Wellhead Protection Program as authorized under the Safe Drinking Water Act Amendments of 1986. IDHW-DOE, Water Quality Bureau will also serve as the agency with responsibility for working with local governments to submit applications for Sole Source Aquifer Demonstration projects that were authorized under the same act.

IDHW-DOE, Water Quality Bureau has already been designated as the lead agency for groundwater quality. The Bureau has developed and updated the state's comprehensive Groundwater Quality Management Plan.

The Bureau is also the recipient of the Clean Water Act 106 Groundwater grants for program development. Among the projects that have been funded by this grant are special management strategies for two of Idaho's major aquifers.

In addition, the state's Drinking Water Program is administered by this agency. IDHW-DOE will be expanding on this framework to incorporate the new groundwater management tools provided by the Wellhead and Aquifer Demonstration programs.

For further information or requests for input, please contact:

Al E. Murrey, Chief
Water Quality Bureau
Idaho Department of Health and Welfare
Division of Environment
450 West State Street
Boise, ID 83720
Phone: (208) 334-5867

Sincerely,

Cecil D. Andrus
Governor

cc: Robie Russel, EPA Region 10
Richard Donovan, Health & Welfare
Ken Brooks, Division of Environment
Al Murrey, Division of Environment

CDA:lmj
0078A

APPENDIX E AN EVALUATION OF SOURCES OF GROUND WATER CONTAMINATION

INTRODUCTION

This report, originally designed as a supplement to the Ground Water Quality Plan, includes a table (Table E-1) of existing programs, rules and regulations, and responsible agencies that manage potential sources of ground water contamination. The table was prepared by IDEQ, in cooperation with IDA and IDWR at the direction of the Ground Water Quality Council. The table satisfies the requirement in the Ground Water Quality Protection Act of 1989, which states that the plan shall identify existing authorities and programs to protect ground water quality.

PURPOSE

In addition to summarizing the existing authorities and programs, the table demonstrates the complexities of ground water quality programs. Each potential source of ground water contamination is managed differently. For example:

- Some sources are not managed by an established program but are managed by rules and regulations
- Some sources are not managed by any program or any rules or regulations
- Some sources are managed by established programs that may not be needed

The table presents the major sources of contamination that directly impact ground water quality. It is not intended to be a comprehensive listing of all possible potential sources of ground water contamination and associated rules and regulations.

The table does not prioritize the potential sources of contamination based on risk to human health and the environment. Instead, the sources are listed alphabetically. Prioritization is often accomplished using risk assessment studies and to date, this has not been done in Idaho.

TABLE HEADINGS

The following is an explanation of the headings on the table.

Potential Source of Ground Water Contamination

This column contains the name or a description of the potential source of ground water contamination.

Ground Water Quality Impact Concerns

This column identifies the main ground water contamination concerns from a specific source of contamination.

Management by: Programs and/or Authority

Potential sources of ground water contamination are managed by programs and/or by rules and regulations. Not all sources are managed by an established program but are managed by general rules and regulations which have not been developed and designed for the purpose of protecting ground water. An example of a general set of rules and regulations is the Water Quality Standards and Wastewater Treatment Requirements, which provides management direction for septage, sludge, and surface water quality. Other programs and rules and regulations have only been developed to address one specific potential source. For example, injection wells are managed by the Underground Injection Control Program which has established Rules and Regulations for the Construction and Use of Injection Wells.

The acronyms that are used under the Program and Authority topics are listed below:

CAFO	Confined Animal Feeding Operation
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act (Superfund)
FIFRA	Federal Insecticide, Fungicide and Rodenticide Act
NPDES	National Pollutant Discharge Elimination System
RCRA	Resource Conservation and Recovery Act
SARA	Superfund Amendments and Reauthorization Act
SERC	State Emergency Response Commission

Administered by:
The programs or rules and regulations may be administered by different federal, state and local agencies. Administration may also be the responsibility of several agencies.

These agencies are referred to by acronyms or shortened names and are explained as follows:

ASCS	Agricultural Stabilization and Conservation Service
BLM	Bureau of Land Management (Federal)
CES	Cooperative Extension Services
DOT	Department of Transportation
EPA	Environmental Protection Agency (Federal)
IDA	Idaho Department of Agriculture
IDEQ	Idaho Division of Environmental Quality
IDL	Idaho Department of Lands
IDWR	Idaho Department of Water Resource
IERC	Idaho Emergency Response Commission
ITD	Idaho Transportation Department
Health Dist.	District Health Departments
Local	City or County Governments and other political subdivisions
SAWQP	State Agricultural Water Quality Program
SCC	Soil Conservation Commission
SCD	Soil Conservation District
SCS	Soil Conservation Service (Federal)
USDA	United -States Department of Agriculture

Regulatory or Voluntary

This column identifies whether the source management program is regulatory or voluntary. Regulatory programs generally utilize mandatory source control requirements such as permit conditions or mandatory Best Management Practices (BMPs). Voluntary programs generally utilize source control methods such as education and technical guidance.

Ground Water Protection Addressed Specifically or Non-specifically

When ground water protection is addressed specifically that means the program and/or rules and regulations incorporate ground water quality concerns.

If ground water protection is not specifically addressed that means the program and/or rules and regulations are designed primarily for other reasons, such as health or surface water quality concerns. However, the management of the source for these other purposes may also indirectly benefit ground water quality.

Recommendations and Comments to Improve Ground Water Protection in Existing Programs

The recommendations and comments are interpretations by the DEQ staff, and by the Ground Water Quality Council Agricultural Subcommittee for agricultural sources of contamination. The purpose is to provide specific information for the following reasons:

- To clarify the focus of the program or rules and regulations.
- To provide information on proposed regulations or program changes.
- To identify areas where modifications or addition of information are necessary in existing voluntary or regulatory programs which address the management of sources of ground water contamination.

Table E-1: An Evaluation of Sources of Ground Water Contamination by Related Programs and Authorities - June 1992

Potential Sources of Ground Water Contamination	Ground Water Quality Impact Concerns	Source Management by		Administered By	Program is		Ground Water Protection Addressed		Recommendations and Comments to Improve Ground Water Protection in Existing Programs
		Program	Authority		Reg	Vol	S	NS	
Agricultural Chemical Spills	Infiltration of a release or its chemical constituents through the unsaturated zone, or entry by direct pathways such as poorly constructed wells and surface waters which are hydro-geologically connected to ground water.		SARA, Title III	IERC	X			X	1. Develop guidelines and/or regulations for those agricultural chemicals and quantities that are not regulated under existing programs. IDA, ITD. 2. Encourage beneficial uses of spilled material, IDA, DEQ. 3. Develop informational, educational, and research programs which address ground water protection from agricultural chemical spills. All levels. 4. Encourage the utilization of pertinent research results. All levels. 5. Upgrade IDWR programs.
		Packaging	FIFRA	EPA	X			X	
		Transportation requirements	DOT	DOT, ITD		X		X	
		Contaminated media from com-mercial spills/leaks	RCRA	DEQ, EPA	X			X	
			Recently passed legislation addressing agricultural chemical spills.		X			X	
		Idaho hazardous materials incident command and response support plan		IERC		X		X	
		Injection well program (UIC)	Rules and Regulations for Construction and Use of Injection Wells	IDWR	X			X	
		Well construction program	Rules and Regulations for Well construction Standards	IDWR	X		X		
		Guidelines from various sources				X		X	

Reg = Regulatory, Vol = Voluntary, S = Specific, NS = Non specific

The potential sources of ground water contamination are listed in alphabetical order.

Table E-1 Continued

Potential Sources of Ground Water Contamination	Ground Water Quality Impact Concerns	Source Management by		Administered By	Program is		Ground Water Protection Addressed		Recommendations and Comments to Improve Ground Water Protection in Existing Programs
		Program	Authority		Reg	Vol	S	NS	
Agricultural Land Applied Waste and Wastewater	Application of waste and wastewater in excess of crop needs.	Permits	NPDES	EPA, DEQ	X			X	1. Expand guidance, rules and regulations for land application of waste and wastewater management from processing plants, CAFOS and aquaculture operations and other nonregulated land application activities to protect ground water quality. DEQ, EPA, IDA. 2. Refine BMPs. SCC technical committee. 3. Develop an MOU between appropriate federal/state/local agencies regarding agency roles and responsibilities for land applies waste and wastewater. 4. Address the ground water quality protection shortcomings of the NPDES permit. DEQ, EPA. 5. Research to identify alternative methods land application. CES, DEQ, IDA. 6. Develop informational and educational programs for ground water quality protection from land applied waste and wastewater. All levels.
			Wastewater Land Application Permit Regulations	DEQ	X			X	
			Idaho Water Quality Standards and Wastewater Treatment requirements	DEQ Technical Advisory Committee	X			X	
		Water right permit requirements	Title 42, chapter 2, Idaho Code, Rules and Regulations for Water Appropriations	IDWR	X			X	
		Agricultural waste management	Field Operation Technical Guide(FOTG)	USDA, SCS		X		X	
Agricultural Waste Disposal (i.e. treated seed, crop residue, and animal carcasses)	Infiltration of contaminants associated with such wastes.	Disposal of miscellaneous agricultural wastes	Idaho State Solid Waste Regulations	DEQ, Local government	X			X	1. Develop educational and informational programs which address proper disposal of agricultural wastes. CES, IDA. 2. Evaluate effectiveness of existing programs/regulations for ground water quality protection by appropriate agencies/industry. IDA, DEQ, CES, EPA. 3. Expand and develop guidelines for ground water quality protection from agricultural wastes. DEQ, IDA, CES.
			RCRA, Subtitle D	EPA, DEQ	X			X	
			UIC Permits and Regulations	IDWR	X			X	
		Guidelines/BMPs		IDA		X		X	

Reg = Regulatory, Vol = Voluntary, S = Specific, NS = Non specific
The potential sources of ground water contamination are listed in alphabetical order.

Table E-1 Continued

Potential Sources of Ground Water Contamination	Ground Water Quality Impact Concerns	Source Management by		Administered By	Program is		Ground Water Protection Addressed		Recommendations and Comments to Improve Ground Water Protection in Existing Programs
		Program	Authority		Reg	Vol	S	NS	
Animal Wastes	Infiltration and runoff from CAFOS and dairies with inadequately designed feedlots and waste storage structures	Dairies (Grade A)	Regulations for Grade A Dairies and Pasteurization Plants	IDA (7/1/92)	x			x	1. The focus of the program is on surface water quality rather than ground water quality. 2. SCDs should include an inventory of statewide CAFO operations in their five year program. SCD. 3. Establish a monitoring and research program to determine the degree of CAFO impacts on ground water quality. CES/DEQ, IWRRI. 4. Develop informational and educational programs for ground water protection from CAFOS at all levels. 5. Provide additional personnel for technical assistance to design and implement CAFO waste management systems. SCS, DEQ IDA. 6. Provide financial/cost share assistance for implementation of CAFO waste management systems. ASCS, SCS-RCD, SAWQP. 7. Address the ground water quality protection shortcomings of the NPDES permit. DEQ, EPA. 8. Coordinate Requirements of all agencies into CAFO management systems. SCC. 9. Expand and promote Idaho waste management guidelines for CAFOS to address ground water quality protection DEQ lead. 10. The focus of the program is on surface water quality rather than ground water quality.
		Dairies (Grade B)	Idaho Dairy Laws, Rules and Regulations	IDA	X			X	
			Waste Management Guidelines	DEQ		X		X	
		CAFOS	NPDES Permit	EPA, DEQ	X			X	
		Compliance checks and complaint response	Idaho Water Quality Standards and Wastewater Treatment Requirements	DEQ Technical Advisory Committee	X			X	
		Water right permitting	Title 42, Chapter 2, Idaho Code, Rules and Regulations for Water Appropriations	IDWR	X			X	
		Concentrated animal feedlot operations waste management	Idaho Waste Management Guidelines	DEQ Technical Advisory Committee		X		X	
		Financial/cost share assistance for implementation		ASCS, SCS-RCD, SCD		X		X	
		Technical assistance for waste management system evaluation and design.		ASCS, SCS, SAWQP		X		X	

Reg = Regulatory, Vol = Voluntary, S = Specific, NS = Non specific
The potential sources of ground water contamination are listed in alphabetical order.

Table E-1 Continued

Potential Sources of Ground Water Contamination	Ground Water Quality Impact Concerns	Source Management by		Administered By	Program is		Ground Water Protection Addressed		Recommendations and Comments to Improve Ground Water Protection in Existing Programs
		Program	Authority		Reg	Vol	S	NS	
Aquacultural Wastes	Infiltration and wastewater runoff from inadequately constructed waste storage structures.	Permits and inspection	NPDES Permits	EPA, DEQ	X			X	1. Develop design standards for waste storage ponds, lagoons. DEQ, SCS, IDA. 2. Develop educational and informational programs for aquaculture waste management practices at all levels.
			Idaho Water Quality Standards and Wastewater Treatment Requirements	DEQ	X			X	
		Public interest criteria of water rights		IDWR		X		X	
		BMPs system management				X		X	
		Technical assistance with facility design and operation		Industry		X		X	
Hazardous Wastes	Infiltration of wastes to ground water from improperly stored or improperly disposed of hazardous wastes	Hazardous Waste	RCRA	EPA	X		X		Generators of very small quantity wastes are exempt from the regulations.
			Idaho Rules, Regulations and Standards for Hazardous Waste	DEQ	X		X		
Household Hazardous Wastes	Household hazardous wastes that are improperly stored and disposed of can leach into ground water.		Voluntary: Based on education and information	Local government		X		X	Public education is important for the control of this source.

Reg = Regulatory, Vol = Voluntary, S = Specific, NS = Non specific
The potential sources of ground water contamination are listed in alphabetical order.

Table E-1 Continued

Potential Sources of Ground Water Contamination	Ground Water Quality Impact Concerns	Source Management by		Administered By	Program is		Ground Water Protection Addressed		Recommendations and Comments to Improve Ground Water Protection in Existing Programs
		Program	Authority		Reg	Vol	S	NS	
Injection Wells	Disposal of irrigation tail water or other runoff water which contains chemicals, organic material, petroleum products and oil products into unpermitted, poorly maintained and improperly closed or unauthorized abandoned disposal wells, lava tubes, fractured rock, gravel pits, etc.	Underground Injection Control	Safe Drinking Water Act	EPA, IDWR	X		X		1. Promote, develop and revise BMP in regard to increasing water quality and decreasing water quantity of irrigation tail water and other runoff water entering injection wells and other disposal systems. SCC technical committee. 2. Continue to improve educational and informational efforts IDWR, EPA. 3. Identify contributors responsible for low water quality injectate and require that they share responsibility with owner/operator when more than one person, party or entity utilizes an injection well. IDWR. 4. Ascertain the effect of injection well use on ground water quality by obtaining support for research to determine the fate of contaminants entering the subsurface environment through injection wells. IDWR, University of Idaho, IFBF. 5. Develop guidelines and/or regulations for disposal systems that are not regulated under existing regulations. 6. Encourage land user participation in SCD and other local programs that may provide BMP planning, implementation, and technical assistance. SCD. 7. Evaluate and revise regulations as necessary to provide increased protection for ground water from injection wells and other disposal methods; strengthen compliance monitoring and enforcement efforts by obtaining support for increased well inspections, more detailed injectate characterization, emergency response capability, and penalties or well closure. IDWR, EPA. 8. Not all well, excavations or openings are regulated by the program. Limited monitoring does not ensure compliance with the regulations.
			Idaho Rules and Regulations for Construction and Use of Injection Wells	IDWR	X		X		
			Rules and Regulations for Well Construction Standards	IDWR, EPA	X		X		
		Operation Outreach		IDWR, EPA		X	X		

Reg = Regulatory, Vol = Voluntary, S = Specific, NS = Non specific

The potential sources of ground water contamination are listed in alphabetical order.

Table E-1 Continued

Potential Sources of Ground Water Contamination	Ground Water Quality Impact Concerns	Source Management by		Administered By	Program is		Ground Water Protection Addressed		Recommendations and Comments to Improve Ground Water Protection in Existing Programs
		Program	Authority		Reg	Vol	S	NS	
Land Use Activities	Inadequate planning and zoning can result in impacts to ground water below land use activities. Proper protection is needed for wellhead setbacks and well-head protection from land use activities.	Wellhead Protection	Safe Drinking Water Act, Amendments (1986)	EPA, DEQ		X	X		1. Implementation of a wellhead protection plan by a local community is voluntary. 2. Some counties have not implemented a comprehensive land use program to date.
		Planning and Zoning	Title 67, Chapter 65, Idaho Code, Comprehensive Land Use Act	Local City and County Governments	X			X	
Mining Using Cyanide	Leaching excessive amounts of cyanide into the ground water	Ore processing by cyanidation	Rules and Regulations for ore processing by cyanidation	DEQ	X		X		Leak detection is not required beneath the leach pads which hold ore piles.
Municipal and Industrial (includes food processing) surface impoundments	Leakage and infiltration of wastes within impound-ments to ground water		Idaho Water Quality Standards and Wastewater Treatment Requirements	DEQ, IDWR	X			X	Leak detection and ground water monitoring is not generally required for surface impoundments.
Municipal and industrial (includes food processing) wastewaters applied to the land surface		Wastewater-Land Application Permits	Wastewater-Land Application Permits Regulations	DEQ	X		X		Feedlot dairies and mining operations are excluded from the regulations.
Pesticides/ Agricultural Chemicals		Agricultural Chemicals							State guidance for the protection of ground water from pesticides will be developed.
a) Mixing and Loading	Uncontained leakage and spills during mixing and loading activities, and backsiphoning into water source.	Label requirements for mixing procedures	FIFRA	EPA, IDA	X			X	1. Evaluate existing information and develop standardized guidelines. IDA, GWR team. 2. Develop educational and informational programs at all levels. SCS, U of I, CES, DEQ, IDA, Industry

Reg = Regulatory, Vol = Voluntary, S = Specific, NS = Non specific
The potential sources of ground water contamination are listed in alphabetical order.

Table E-1 Continued

Potential Sources of Ground Water Contamination	Ground Water Quality Impact Concerns	Source Management by		Administered By	Program is		Ground Water Protection Addressed		Recommendations and Comments to Improve Ground Water Protection in Existing Programs
		Program	Authority		Reg	Vol	S	NS	
a) Mixing and Loading (cont.)		Reinstate recycling and reuse provisions	RCRA	EPA, IDA, DEQ, Industry	X			X	3. Develop state regulations/guidelines for proper mixing and loading procedures. EPA, Industry, U of I. 4. Develop design standards for mixing and loading areas. IDA, Industry, EPA, DEQ. 5. EPA to finalize mixing and loading regulations. (CFR Part 165) EPA. 6. Expand wellhead protection at all levels. DEQ, IDA, Local EPA, IDWR.
		Voluntary guidelines		Various programs and agencies		X		X	
b) Storage and handling	Leakage or spills from storage containers and tanks as well as agrichemical-laden surface water runoff at facilities that lack adequate containment measures.	Label Requirements	FIFRA	EPA, IDA	X			X	1. Evaluate existing information and develop standardized guidelines. IDA, Ground Water Review Team. (GWR). 2. Broaden scope of applicability Section 15 regulations. IDA 3. Develop state regulations for containment measures including SPCC plans at larger facilities. IERC. 4. Develop standardized guidelines for containment design. IDA. 5. EPA to finalize storage regulations (CFR Part 165). EPA. 6. Develop education and information dissemination programs at all levels. SCS, U of I, CES DEQ, IDA, Industry, IDWR. 7. Expand wellhead protection. DEQ, IDA, local EPA, IDWR. 8. Development of a State Pesticide Management Plan (SMP). IDA, DEQ. 9. Coordinate siting of agricultural chemical storage facilities with local planning and zoning entities. IDA, DEQ, EPA.
		Pesticide Use Regulations	Idaho Regulations for Pesticide Use	IDA	X			X	
			Local fire code and building code ordinances	State and local Fire Marshall	X			X	
		USTs	UST Regulations	State and local Fire Marshall EPA, DEQ	X			X	
		Public Drinking Water Systems	Idaho Public Drinking Water Regulations	EPA, DEQ, IDWR	X			X	
		Contaminated soils from commercial applicator storage related spills	RCRA	EPA, IDA, DEQ	X			X	
		Voluntary guidelines from various sources.				X		X	

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Table E-1 Continued

Potential Sources of Ground Water Contamination	Ground Water Quality Impact Concerns	Source Management by		Administered By	Program is		Ground Water Protection Addressed		Recommendations and Comments to Improve Ground Water Protection in Existing Programs
		Program	Authority		Reg	Vol	S	NS	
c. Application/ Agricultural Practices	Infiltration of agricultural chemicals or their chemical constituents below the crop root zone or entry by direct pathways, such as poorly constructed wells and surface waters, which are hydrologically connected to ground water.	Labeling requirements; cultural practice restrictions	FIFRA	EPA, IDA, U of I	X			X	1. Develop a cooperative agreement between local Soil Conservation Districts and an operator that provides for developing a water quality management plan that addresses surface water and ground water pollution sources and satisfies all applicable state and federal requirements for water quality protection which includes the implementation of BMPs. Local SCDs. 2. Develop and update ground water quality protection BMPs for agricultural chemical application/ cultural practices. SCC lead, technical committee. 3. Coordinate irrigation programs and other BMPs within CES, SCS, Bureau of Reclamation, IDWR. 4. Develop and implement a SMP. IDA, DEQ, EPA. 5. Address ground water quality protection in the revision of the APAP. SCC and SAWQP. 6. Encourage expansion of SAWQP for ground water projects. IDA, Industry, DEQ. 7. Develop informational, educational and research programs (especially promote development and distribution of ground water protection hand books: Pesticide, Nutrient, and Irrigation Management) which address ground water protection from agricultural chemical spills. All entities. 8. Accelerate and continue federal projects such as USDA ground water demonstration projects. USDA lead, SCS, CES, ASCS, SCD, DEQ IDWR, Industry. 9. Encourage land user participation in SCD and other local programs that may provide BMP planning, implementation and technical assistance. All entities. 10. Encourage expansion and continuation of privately (i.e. Farm Bureau) and publicly sponsored ground water quality programs including pesticide use information, vulnerability mapping and others. All entities.
			Chapter 34, Pesticide Law	IDA	X			X	
			1990 Farm Bill, Water Quality Plan Provisions	USDA, U of I, DEQ, IDA, EPA, SCD		X		X	
		Construction of wells	Rules and Regulations for Well Construction Standards, Regulations for Well Drillers	IDWR	X		X		
		Water rights	Rules and Regulations for Water Approp.	IDWR	X			X	
		BMPs, pesticide, nutrient, water management plans, conservation cropping practice		SCC lead and technical committee		X		X	
		Irrigation management guidelines		SCS, U of I, Bureau of Reclamation		X		X	

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Table E-1 Continued

Potential Sources of Ground Water Contamination	Ground Water Quality Impact Concerns	Source Management by		Administered By	Program is		Ground Water Protection Addressed		Recommendations and Comments to Improve Ground Water Protection in Existing Programs
		Program	Authority		Reg	Vol	S	NS	
d. Waste Disposal	Improper disposal of agricultural chemical containers and unused product	Construction and use of injection wells	Idaho Rules and Regulations for Construction and Use of Injection Wells	IDWR, EPA	X			X	1. Promote informational and educational programs to address proper disposal of agricultural chemical containers and unused products. All levels. 2. Evaluate effectiveness of existing programs/regulations for ground water quality protection by appropriate agencies/ industry. Ground water review team. 3. EPA to finalize disposal regulations (CFR Part 165). EPA. 4. Development of a SMP. IDA lead.
		State authority for IDA to develop regulations	Chapter 34, Idaho Code	IDA	X			X	
		Disposal of agricultural chemical hazardous wastes	RCRA	DEQ, EPA	X			X	
		Label requirements	FIFRA	IDA, EPA	X			X	
		Small generator/ hazardous materials	RCRA	DEQ, Health Districts, local governments	X			X	
		Construction and use of injection wells	Idaho Rules and Regulations for Construction and use of Injection wells	IDWR, EPA	X			X	
		CES, EPA recommended practices		CES, IDA, DEQ		X		X	
		Household hazardous waste collection programs		DEQ, local government, industry		X		X	
Petroleum and chemicals stored in underground storage tank systems	Leaking tanks and overfilling tanks cause contamination of soil and ground water.	Underground Storage Tank Systems	RCRA	EPA, DEQ	X		X		Small tanks, home heating oil tanks and farm and residential tanks holding 1,100 or less of motor fuel used for noncommercial purposes are excluded from these regulations.

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The potential sources of ground water contamination are listed in alphabetical order.

Table E-1 Continued

Potential Sources of Ground Water Contamination	Ground Water Quality Impact Concerns	Source Management by		Administered By	Program is		Ground Water Protection Addressed		Recommendations and Comments to Improve Ground Water Protection in Existing Programs
		Program	Authority		Reg	Vol	S	NS	
Sanitary landfills, community composting, agricultural and food processing wastes and other non-hazardous wastes	Leachate from improperly constructed or maintained landfills contaminates ground water and nearby drinking water sources.	Solid Waste	RCRA	EPA	X		X		The new EPA solid waste regulations have direct protection components for ground water. Idaho will need to revise the existing regulations to meet the federal requirements.
			Idaho Solid Management Regulations and Standards	DEQ, Health Districts, local government	X			X	
Septage - the contents of septic tanks and grease and sand traps	Leakage spillage and overfilling of contents as well as inadequate disposal of septage infiltrates into soil and ground water or runs off into surface waters which are interconnected to ground water.	Septage	Regulations governing the cleaning of septic tanks	Health Districts	X			X	There is a lack of disposal sites willing to accept the pumped contents from grease and sand traps because petroleum products, heavy metals and polychlorinated byphenyls (PCBs) may be present.
Septic Tanks/Drainfields	Improperly constructed or illegal systems can contaminate ground water.	On-site sewage systems (individual and commercial)	Idaho Regulations for Individual and Subsurface Sewage Disposal Systems	Health Districts	X			X	There is no guidance for the abandonment of septic tanks or drainfields.
Significantly contaminated sites with unwilling or no responsible parties.	Leaves outstanding ground water contamination if responsible parties are not found.	CERCLA	CERCLA, SARA Amendments (1986)	EPA, DEQ	X		X		Less than 1000 sites are on the federal list for clean up.
Sludge Usage			Idaho Water Quality Standards and Wastewater Treatment Requirements	DEQ	X		X		Ground water monitoring is not routinely required, however, proposed federal regulations require such monitoring.

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Table E-1 Continued

Potential Sources of Ground Water Contamination	Ground Water Quality Impact Concerns	Source Management by		Administered By	Program is		Ground Water Protection Addressed		Recommendations and Comments to Improve Ground Water Protection in Existing Programs
		Program	Authority		Reg	Vol	S	NS	
Spills		SERC	Emergency Planning and Community Right to Know Act SARA Title III	EPA	X		X		
			Idaho Hazardous Substance Response Act	DEQ, local agencies	X		X		
Storm Water Runoff	Storm water containing petroleum, greases, VOCs and organic material infiltrates down into ground water.	National Urban Runoff (Storm Water Runoff)	NPDES Permit	EPA, local government	X			X	1. The national program is only mandatory for communities of 100,000 or more and commercial sites greater than five acres. 2. The focus of the program is on the surface water quality rather than ground water quality.
Surface Mining Operations		Surface Mining	Rules and Regulations Governing Exploration and Surface Mining Operations in Idaho	IDL, BLM, Forest Service	X			X	There are no requirements for ground water monitoring at surface mining sites.
			Rules and Regulations Governing Placer and Dredge Mining Operations in Idaho		X			X	

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Table E-1 Continued

Potential Sources of Ground Water Contamination	Ground Water Quality Impact Concerns	Source Management by		Administered By	Program is		Ground Water Protection Addressed		Recommendations and Comments to Improve Ground Water Protection in Existing Programs
		Program	Authority		Reg	Vol	S	NS	
Urban/Non Agricultural Chemicals	Infiltration of non-agricultural chemicals, a chemical release, or its chemical constituents through the unsaturated zone; or entry by direct pathways such as poorly constructed wells, inadequate water systems back-siphoning protect-ion, improper cross connection, and surface waters which are hydro-logically connected to ground water.	Labeling requirements	FIFRA	IDA, EPA	X			X	1. Research studies to determine degree of ground water contamination in urban areas , DEQ, IDA. 2. Research studies to identify alternative methods of urban and non agricultural uses of chemicals. CES, Industry, EPA. . Develop informational, educational, and training programs for commercial and residential users. All entities. 4. Conduct urban pesticide sales study. IDA. 5. Increased development of outreach programs for information and education. CES, IDA, EPA.
		Commercial applicators	Chapter 34, Idaho Code	IDA	X			X	
		Community awareness programs		IDA, CES, Industry		X		X	
		Guidelines from various sources				X		X	
Well construction and abandon-ment.	Contamination of ground water via improperly constructed or abandoned wells.	Well Construction Standards	Rules & Regulations for Well Construction Standards	IDWR	X		X		1. Update IDWR rules and regulations to better address water mixing between aquifers and siting of wells near potential contamination sources. IDWR. 2. Increase support for education of IDWR regulatory personnel. IDWR. 3. Expand public and driller awareness and cooperation through increased communication with IDWR ground water personnel. IDWR. 4. Increase support for field inspections for well construction and locating improperly abandoned wells. IDWR.
			Idaho Code and Rules and Regulations Governing Water Well Drillers Licenses	IDWR	X		X		
			Regulations for Individual Subsurface Sewage Systems	Health Districts	X		X		
			Idaho Drinking Water Regulations for Public Systems	DEQ	X		X		
			Idaho Guidelines for Non-Public Water Systems	Health Districts		X	X		

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The potential sources of ground water contamination are listed in alphabetical order.

APPENDIX F BASIC WELLHEAD PROTECTION AREA DELINEATION FOR THE STATE OF IDAHO

This appendix documents the three main components used for the derivation of the basic wellhead protection areas for the major aquifers in Idaho. These components are:

1. Data compilation
   a. The determination of transmissivity values from existing state wide pump test data.
   b. Compilation of hydrologic data values from literature search.
2. Hydrologic data value selection for the time of travel calculations.
3. The calculations of the time of travel boundaries for each hydrogeologic setting.

DATA COMPILATION

Hydrologic data for the major hydrogeologic settings in Idaho were compiled from two main sources:

- IDWR - Energy Division
- Literature search

Data from IDWR were used to derive transmissivities. The literature search compiled hydrologic information on transmissivities, aquifer thicknesses, hydraulic conductivity, gradient, and effective porosity.

IDWR - ENERGY DIVISION

Pump Test Data

The Energy Division of IDWR collected municipal well pump test data between 1987 and 1990. The purpose of the data was to determine the efficiency of municipal well pumps.

Of the 470 wells in the study, 131 had sufficient data (static water levels, pumping water levels and flow rates) to derive transmissivity values from the calculated specific capacity. The modified nonleaky artesian formula (Walton, 1962) was used to derive the transmissivity values. Pumping times of 45 minutes and a conservative storage coefficient of .0001 were used in the calculations for all wells except those determined to produce from the Rathdrum Prairie aquifer. The nominal radius of the well was estimated based on the flow rate of the well.

TABLE F-1: IDAHO DEPARTMENT OF WATER RESOURCES ENERGY DATA

Aquifer	City	Pumpid	Testdat	SWL	PWL	PWL-SWL	Flow	SC	Est R(')	Est R(")	T(art.)
Alluv	Challis	West Well #2	19880802	317.0	487.5	170.5	522	3.1	0.83	10	4690
Alluv	Rockland	25-hp Vertical Turbin	19890906	111.0	177.0	66.0	245	3.7	0.67	8	5970
Alluv	New Meadows	Submersible	19890901	19.0	78.0	59.0	253	4.3	0.67	8	6980
Alluv	Rockland	25-hp Submersible	19890906	111.0	177.0	66.0	322	4.9	0.67	8	8020
Alluv	Arimo	#1	19890717	30.0	56.0	26.0	346	13.3	0.67	8	23500
Alluv	Ketchum	Well #2	19880929	18.0	39.3	21.3	347	16.3	0.67	8	29100
Alluv	Bancroft	City Pump	19890719	95.0	104.0	9.0	188	20.9	0.67	8	38000
Alluv	Mackay	30-hp Submersible	19890913	11.0	27.0	16.0	420	26.2	0.83	10	47100
Alluv	Mackay	Well Pump #2	19910819	11.7	22.7	11.0	290	26.4	0.67	8	48700
Alluv	Tetonia	Park Well	19891107	101.0	110.0	9.0	395	43.9	0.83	10	81600
Alluv	Riggins	Well #2-new Pump	19900612	50.0	57.0	7.0	388	55.4	0.83	10	104000
Alluv	Grace	Well Pump	19890719	161.0	172.0	11.0	660	60.0	1.00	12	111000
Alluv	Bancroft	Railroad Pump	19890719	106.0	108.0	2.0	115	57.4	0.50	6	115000
Alluv	Ketchum	Well #1	19880929	59.3	75.6	16.3	1054	64.7	1.10	13.25	118000
Alluv	Malad	Five Points Well	19890718	78.0	82.0	4.0	263	65.7	0.67	8	129000
Alluv	Dayton	Park Well	19890718	52.0	56.0	4.0	333	83.3	0.83	10	161000
Alluv	Arco	Park Pump	19891016	125.0	135.0	10.0	906	90.6	0.00	12	172000
Alluv	Sun Valley	Pump #8	19880927	19.0	29.9	10.9	1139	104.5	1.10	13.25	198000
Alluv	Pocatello	Well #32	19880608	59.2	71.5	12.3	1604	130.4	1.10	13.25	251000
Alluv	Pocatello	Well #29	19880607	70.8	87.9	17.1	2493	145.8	1.27	15.25	277000
Alluv	Pocatello	Well #2	19880607	34.9	43.5	8.6	1265	147.0	1.10	13.25	285000
Alluv	Sun Valley	Pump #5	19880927	12.5	16.0	3.5	787	224.9	1.00	12	452000
Alluv	Pocatello	Well #27	19880607	63.3	69.2	5.9	1623	275.2	1.10	13.25	554000
Alluv	Sun Valley	Pump #7	19880927	20.0	23.5	3.5	1039	296.9	1.10	13.25	601000
Alluv	Pocatello	Well #18	19880608	66.2	72.6	6.4	2020	315.5	1.27	15.25	630000
Alluv	Pocatello	Pip Well	19880608	69.6	72.6	3.0	1188	395.8	1.10	13.25	815000
Alluv	Malad	Spring Creek Well/5	19890718	84.0	85.0	1.0	413	413.2	0.83	10	881000
Alluv	Pocatello	Well #16	19880607	46.7	49.5	2.8	2267	809.8	1.27	15.25	1710000
Alluv	Pocatello	Well #28	19880607	34.6	35.9	1.3	1755	1349.8	1.27	15.25	2930000
Alluv	Pocatello	Well #31	19880608	62.2	64.1	1.9	2937	1546.0	1.27	15.25	3380000
Alluv	Pocatello	Well #12	19880607	43.3	44.7	1.4	2812	2008.2	1.27	15.25	4460000
Alluv	Pocatello	Well #10	19880607	52.4	53.9	1.5	3419	2279.5	1.60	19.25	4970000
Alluv	Pocatello	Well #21	19880607	79.6	80.1	0.5	1581	3161.8	1.10	13.25	7300000
Alluv	Pocatello	Cree Well	19880606	35.4	35.5	0.1	388	3877.0	0.83	10	9320000
Alluv	Pocatello	Well #22	19880607	87.5	87.6	0.1	871	8714.0	1.10	13.25	2E+07
CR Basalt	Kooskia	Well #3	19881004	101.0	350.0	249.0	246	1.0	0.67	8	1420
CR Basalt	Council	Pump #1	19870619	277.2	374.2	97.0	337	3.5	0.83	10	5380
CR Basalt	Moscow	Cemetary Well	19880822	170.4	228.2	57.8	467	8.1	0.83	10	13300
CR Basalt	Moscow	Cemetary Well	19880822	170.4	228.2	57.8	708	12.3	1.00	12	20300
CR Basalt	Council	Pump #2	19870619	50.0	79.2	29.2	356	12.2	0.83	10	20700
CR Basalt	Kooskia	Well #1	19881004	43.5	64.0	20.5	248	12.1	0.67	8	21200
CR Basalt	Kooskia	Well #2	19881004	45.5	66.0	20.5	255	12.4	0.67	8	21800
CR Basalt	Univ of Idaho	Well #4	19880824	195.0	295.4	100.4	1901	18.9	1.27	15.25	31300
CR Basalt	Moscow	Well #8	19880822	370.2	404.9	34.7	980	28.2	1.10	13.25	49000
CR Basalt	Moscow	Well #6	19880823	344.9	376.1	31.2	1339	42.9	1.10	13.25	76700
CR Basalt	Moscow	Well #2	19880822	138.7	153.8	15.1	864	57.2	1.10	13.25	104000
CR Basalt	Univ of Idaho	Well #3	19880824	297.0	301.0	4.0	1812	453.1	1.27	15.25	924000
CR Basalt	Lewiston	Well #5	19880713	150.6	152.0	1.4	1180	842.6	1.10	13.25	1810000
E. Snake	Hollister	Well Pump	19890816	158.0	189.0	31.0	197	6.4	0.50	6	11100
E. Snake	Roberts	Well #2	19880626	23.9	47.1	23.2	407	17.6	0.83	10	30600
E. Snake	Filer	Pump #5	19870603	42.4	60.4	18.0	345	19.2	0.83	10	33700
E. Snake	Teton	Well #2	19891019	91.5	100.0	8.5	252	29.6	0.67	8	55300

Header Explanation for Table F- 1

Aquifer = Aquifer Name
- Alluv = Unconsolidated Alluvium
- CR Basalt = Columbia River Basalts
- E. Snake = Eastern Snake River Plain Basalts
- MVS-VS = Mixed Volcanic and Sedimentary Rocks, Primarily Volcanic Rocks
- MVS-Sed = Mixed Volcanic and Sedimentary Rocks, Primarily Sedimentary Rocks
- Rathdrum = Rathdrum Prairie Aquifer

City = City location of the well
Pumpid = Well identification
SWL = Static water level, in feet
PWL = Pumping water level, in feet
PWL-SWL = Difference between PWL and SWL, in feet
Flow = Calculated flow rate, in gallons per minute (gpm)
SC = Specific capacity, in gallons per minute per foot of drawdown
Est R('); Est R(") = Estimated radius of the well in feet; inches
T(art.) = Transmissivity, in gallons per day per foot (gpd/ft) (Uses confined aquifer storage coefficient)

TABLE F-1 Continued

Aquifer	City	Pumpid	Testdat	SWL	PWL	PWL-SWL	Flow	SC	Est R(')	Est R(")	T(art.)
E. Snake	Roberts	Well #3	19880626	64.4	87.6	23.2	727	31.3	1.00	12	55500
E. Snake	Shelley	Pump #4	19880525	103.0	144.6	41.6	1422	34.2	1.10	13.25	60200
E. Snake	Shelley	Pump #1	19880525	107.7	125.0	17.3	576	33.3	0.83	10	60800
E. Snake	Burley	#1	19890804	205.0	228.0	23.0	821	35.7	1.00	12	63800
E. Snake	Ashton	#1	19890912	28.0	44.0	16.0	900	56.3	1.00	12	103000
E. Snake	Aberdeen	Well #2	19870604	25.0	33.0	8.0	634	79.2	0.83	10	153000
E. Snake	Ammon	Well #6	19880524	86.0	102.2	16.2	1340	82.7	1.10	13.25	154000
E. Snake	Idaho Falls	Well #15 Main	19870626	106.0	124.0	18.0	2093	116.3	1.27	15.25	218000
E. Snake	Ririe	Pump #2	19871029	34.0	35.0	1.0	106	106.3	0.50	6	221000
E. Snake	Iona	Tank Pump	19870625	207.0	216.5	9.5	1312	138.1	1.27	15.25	261000
E. Snake	Rigby	Shop Well	19891018	15.0	22.0	7.0	1047	149.5	1.10	13.25	290000
E. Snake	Ammon	Well #7	19880524	65.0	74.4	9.4	1410	150.0	1.10	13.25	291000
E. Snake	Burley	#4	19890804	222.0	230.0	8.0	1227	153.3	1.17	14	295000
E. Snake	Rupert	Well #1	19890801	185.0	190.0	5.0	833	166.7	1.10	13.25	325000
E. Snake	Idaho Falls	Well #11 1435 RPM	19870624	195.0	208.0	13.0	3587	276.0	1.94	23.25	518000
E. Snake	Ririe	Pump #3	19871029	40.0	41.0	1.0	251	251.0	0.67	8	533000
E. Snake	Idaho Falls	Well #4 Main	19870623	155.0	172.0	17.0	4942	290.7	1.94	23.25	547000
E. Snake	Rigby	Well Pump #2	19891018	15.0	22.0	7.0	2441	348.8	1.27	15.25	700000
E. Snake	Idaho Falls	Well #11 1610 RPM	19870624	195.0	208.0	13.0	4861	373.9	1.10	13.25	767000
E. Snake	Dubois	Well #1	19891020	355.0	356.0	1.0	404	403.6	0.83	10	860000
E. Snake	Rigby	Harwood #3	19891018	15.0	16.0	1.0	420	419.9	0.83	10	896000
E. Snake	Dubois	Well #3	19891020	355.0	356.0	1.0	613	613.1	0.83	10	1330000
E. Snake	Shelley	Pump #3	19880525	92.6	95.7	3.1	1995	643.4	1.27	15.25	1340000
E. Snake	Shoshone	Pump #3	19871029	210.8	212.1	1.3	824	633.9	1.00	12	1350000
E. Snake	Rexburg	Well #5	19891017	324.0	327.0	3.0	2060	686.7	1.27	15.25	1430000
E. Snake	Rupert	Well #2`	19890801	185.0	187.0	2.0	1681	840.3	1.10	13.25	1800000
E. Snake	Rexburg	Well #1	19891017	208.0	210.0	2.0	2188	1093.8	1.27	15.25	2350000
E. Snake	Rexburg	Well #6	19891017	208.0	210.0	2.0	2246	1122.8	1.27	15.25	2410000
E. Snake	Jerome	Well Pump #2	19890816	284.8	285.8	1.0	1396	1396.4	1.27	15.25	3040000
E. Snake	Idaho Falls	Well #2 Main	19870622	167.0	169.0	2.0	2803	1401.3	1.27	15.25	3050000
E. Snake	Jerome	Well Pump #1	19890816	284.8	285.8	1.0	1493	1492.9	1.10	13.25	3310000
E. Snake	Idaho Falls	Well #3	19870626	165.0	166.0	1.0	4719	4718.6	1.94	23.25	1E+07
MVS-VS	Kuna	Process Pump	19880815	240.0	310.5	70.5	223	3.2	0.67	8	5030
MVS-VS	Kuna	Well #2	19880815	93.7	112.3	18.6	580	31.2	1.00	12	55300
MVS-VS	Kuna	Well #3	19880815	84.6	115.9	31.3	1801	57.5	1.27	15.25	102000
MVS-VS	Grandview	Pump #2	19880830	82.7	85.4	2.7	226	83.5	0.67	8	166000
MVS-VS	Grandview	Pump #1	19880830	79.7	82.1	2.4	246	102.5	0.67	8	206000
MVS-SED	Homedale	Well #2	19880602	44.2	222	178.1	198	1.1	0.5	6	1700
MVS-SED	Homedale	Old City Hall Well	19880602	41.8	216.0	174.2	206	1.2	0.67	8	1730
MVS-SED	Eagle	#2 Submersible	19910520	50.9	133.8	82.9	266	3.2	0.67	8	5100
MVS-SED	Nampa	Well #10	19880518	17.0	191.0	174.0	605	3.5	0.83	10	5380
MVS-SED	Caldwell	Well #9 1670 RPM	19880816	50.5	233.2	182.7	779	4.3	1.00	12	6510
MVS-SED	Caldwell	Well #13	19880816	10.7	149.5	138.8	772	5.6	1.00	12	8680
MVS-SED	Caldwell	Well #10	19880816	11.6	145.0	133.4	751	5.6	1.00	12	8790
MVS-SED	Homedale	Park Well	19880602	4.6	42.5	37.9	207	5.5	0.67	8	9050
MVS-SED	Nampa	Well #8	19880517	56.1	171.2	115.1	862	7.5	1.10	13.25	11700
MVS-SED	Caldwell	Well #7 1870 RPM	19880816	6.0	110.0	104.0	889	8.5	1.00	12	13700
MVS-SED	Parma	Well #7	19880826	24.5	138.4	113.9	1033	9.1	1.10	13.25	14400
MVS-SED	Caldwell	Well #11	19880816	10.6	112.2	101.6	986	9.7	1.00	12	15800
MVS-SED	Wilder	Pump #2	19880823	98.0	132.0	34.0	337	9.9	0.83	10	16600
MVS-SED	Caldwell	Well #6	19880816	9.5	90.0	80.5	864	10.7	1.00	12	17600

Header Explanation for Table F- 1

Aquifer = Aquifer Name
- Alluv = Unconsolidated Alluvium
- CR Basalt = Columbia River Basalts
- E. Snake = Eastern Snake River Plain Basalts
- MVS-VS = Mixed Volcanic and Sedimentary Rocks, Primarily Volcanic Rocks
- MVS-Sed = Mixed Volcanic and Sedimentary Rocks, Primarily Sedimentary Rocks
- Rathdrum = Rathdrum Prairie Aquifer

City = City location of the well
Pumpid = Well identification
SWL = Static water level, in feet
PWL = Pumping water level, in feet
PWL-SWL = Difference between PWL and SWL, in feet
Flow = Calculated flow rate, in gallons per minute (gpm)
SC = Specific capacity, in gallons per minute per foot of drawdown
Est R('); Est R(") = Estimated radius of the well in feet; inches
T(art.) = Transmissivity, in gallons per day per foot (gpd/ft) (Uses confined aquifer storage coefficient)

TABLE F-1 Continued

Aquifer	City	Pumpid	Testdat	SWL	PWL	PWL-SWL	Flow	SC	Est R(')	Est R(")	T(art.)
MVS-SED	Caldwell	Well #14	19880817	34.9	85.8	50.9	679	13.3	0.83	10	22800
MVS-SED	Garden City	#1	19890726	132.5	160.0	27.5	368	13.4	0.83	10	22900
MVS-SED	Caldwell	Well #8 1200 RPM	19880817	9.4	39.4	30.0	566	18.9	1.00	12	32200
MVS-SED	Notus	#2	19890524	30.0	55.0	25.0	490	19.6	0.83	10	34500
MVS-SED	Nampa	Colorado	19880619	9.5	45.0	35.5	774	21.8	1.00	12	37700
MVS-SED	Nampa	Well #7	19880518	11.3	41.8	30.5	823	27.0	1.10	13.25	467o0
MVS-SED	Nampa	Well #9 1280 RPM	19880518	1.0	18.5	17.5	458	26.2	0.83	10	47000
MVS-SED	Eagle	#1 Submersible	19910520	40.0	59.0	19.0	539	28.4	0.83	10	51200
MVS-SED	Garden City	#5 (Variable Speed)	19890726	22.0	36.0	14.0	490	35.0	0.83	10	64100
MVS-SED	Middleton	Pump #4	19890808	86.0	135.0	49.0	1903	38.8	1.27	15.25	87600
MVS-SED	Nampa	Well #6	19880517	32.0	49.0	17.0	830	48.8	1.10	13.25	88100
MVS-SED	Caldwell	Well #4	19880817	74.0	80.3	6.3	295	46.9	0.67	8	89900
MVS-SED	Garden City	#43	19890727	15.0	35.0	20.0	1219	60.9	1.10	13.25	111000
MVS-SED	Nampa	Holly	19880619	17.3	27.5	10.2	695	68.1	1.00	12	127000
MVS-SED	Eagle	#3 Submersible	19910520	65.5	69.2	3.7	259	69.9	0.67	8	137000
MVS-SED	Nampa	19th Ave. N.	19880619	3.1	10.0	6.9	591	85.6	1.00	12	162000
MVS-SED	Nampa	Venice	19880519	16.8	22.0	5.2	462	88.8	0.83	10	172000
MVS-SED	Nampa	Juniper Square	19880619	23.0	24.0	1.0	137	137.1	0.50	6	290000
Rathdrum	Coeur d'Alene	Atlas Road Well	19870804	241.0	245.0	4.0	1155	288.7	1.10	13.25	58300
Rathdrum	Coeur d'Alene	Fourth St. Well	19870804	194.5	212.0	17.5	3238	185.0	1.60	19.25	347000
Rathdrum	Coeur d'Alene	Linden St. Well	19870804	169.0	178.0	9.0	2604	289.3	1.27	15.25	574000
Rathdrum	Coeur d'Alene	Atlas Road Well		241.0	245.0	4.0	1155	288.8	1.10	13.25	583000
Rathdrum	Coeur d'Alene	Locust St. Well	19870804	174.0	175.8	1.8	1655	919.7	1.10	13.25	1980000

Header Explanation for Table F- 1

Aquifer = Aquifer Name
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- Rathdrum = Rathdrum Prairie Aquifer

City = City location of the well
Pumpid = Well identification
SWL = Static water level, in feet
PWL = Pumping water level, in feet
PWL-SWL = Difference between PWL and SWL, in feet
Flow = Calculated flow rate, in gallons per minute (gpm)
SC = Specific capacity, in gallons per minute per foot of drawdown
Est R('); Est R(") = Estimated radius of the well in feet; inches
T(art.) = Transmissivity, in gallons per day per foot (gpd/ft) (Uses confined aquifer storage coefficient)

Of the 131 wells, 36 wells were determined to be producing from the Eastern Snake River Plain Basalts, 13 from the Columbia River Basalts, 35 from unconsolidated alluvium, 32 from mixed volcanics and sedimentary rocks (primarily sedimentary), 5 from the Rathdrum Prairie, and 5 from mixed volcanics and sedimentary rocks (primarily volcanic rocks). The derived transmissivity values for the Rathdrum Prairie Aquifer and mixed volcanics and sedimentary rocks (primarily volcanic rocks) were not used because there were not enough data points.

Individual well data and the derived transmissivity values are tabulated by hydrogeologic setting in Table F-1. Average (log mean) transmissivity values are listed in Table F-2.

Table F-2 Average Transmissivity Values IDWR Energy Pump Test Data

Hydrogeologic Setting	#Data Points	Type of Distribution	Average Value (GPD/FT)
East Snake River Plain Basalts	36	Log	352,091
Columbia River Basalts	13	Log	38,435
Alluvium	35	Log	247,711
Mixed Volcanic and Sedimentary Rocks (Primarily sedimentary rocks)	32	Log	26,812

Note: Data for the following aquifers were not used because there were insufficient data points: Mixed Volcanic and Sedimentary (primarily volcanic rocks), Rathdrum Prairie

Literature Search Data

Hydrologic data for transmissivity, aquifer thickness, hydraulic conductivity, gradient, and effective porosity were obtained from literature search and are compiled in Table F-3. The reference numbers on the table correspond to the list of references for this appendix.

Transmissivity (T)

Transmissivity is the rate at which water of a prevailing density and viscosity is transmitted through a unit width of an aquifer or confining bed under a unit hydraulic gradient. It is a function of properties of the liquid, the porous media, and the thickness of the porous media (Fetter, 1988).

To allow ready comparison, all transmissivity data have been converted to gpd/ft if the literature gave the value in units of ft^2/day. The converted values were not rounded.

Table F-3: Hydrologic Data and References for the Basic I Calculations, Idaho Wellhead Protection Program

Hydrogeologic Setting	Transmissivity (T)	Aquifer Thickness (b)	Hydraulic Conductivity (K)	Hydraulic Gradient (I)	Effective Porosity (Ne)	Values Used for Basic I Calculations
East Snake River Plain Basalts	650,000 - 67,240,000 gpd/ft Ref: (12,21,25, 26) 400,000 gpd/ft (Avg) Ref: (18)	Several 100 to 1,000 ft. Ref: (21) 500 - 4,000 ft. Ref: (20)	3,740 - 37,400 gpd/ft^2 Min = 74.8 gpd/ft^2 Max = 74,800 gpd/ft^2 Ref: (2, 23)	.001 - .006 Ref: (23) Gradient as low as .0003 exist. Ref: (26)	.11 - .19 Ref: (3, 17)	T = 400,000 gpd/ft b = 600 ft. I = 0.004 Ne = 0.15
Columbia River Basalts	20,196 - 2,019,600 gpd/ft Ref: (1) 40,000 gpd/ft (Avg) Ref: (18)	20 - 800 ft. Ref: (1, 8)		.0002 Ref: (24)	.004 - .19 Ref: (4) 0.0002 Ref: (13)	T = 40,000 gpd/ft b = 400 ft. I = 0.0002 Ne = 0.1
Rathdrum Prairie	2,019,600 - 97,240,000 gpd/ft Ref: (10,16)	500 - 1,000 ft. Ref: (10, 6) 250 - 400 ft. Ref: (27)	3,740 - 164,560 gpd/ft^2 Ref: (10, 16)	.0004 - .005 Ref: (10, 16) .0005 - .009 Ref: (27)	.25 - .30 Ref: (10)	See Rethdrum Prairies Aquifer delineation in Chapter 3.
Unconsolidated Alluvium	200,000 gpd/ft. (Avg) Ref: (18)	100 ft. estimated	74.8 - 2,992 gpd/ft^2 Ref: (10, 16)	.003 - .02 Ref: (5, 6, 7)	.20 - .35 Ref: (11)	T = 200,000 gpd/ft b = 100 ft. I = 0.01 Ne = 0.3
Mixed Volcanic and Sedimentary Rocks - Primarily Sedimentary Rocks (Example: Boise/ Nampa area)	6,732 - 160,820 gpd/ft Ref: (29) 30,000 gpd/ft (Avg) Ref: (18)	500 - 4,000 ft. Ref: (29) 500 - 1,000 ft. Ref: (33)	74.8 - 748 gpd/ft^2 upper 500 ft. Ref: (29)	.002 - .004 Ref:(22)	.10 - .30 Ref: (11)	T = 30,000 gpd/ft b = 800 ft. I = 0.003 Ne = 0.2
Mixed Volcanic and Sedimentary Rocks - Primarily Volcanic Rocks (Example: Mtn Home)	374,000 gpd/ft Ref: (35)	500 - 600 ft. Ref: (30)		.012 - .015 Ref: (22)	.11 - .19 Ref: (11)	T = 400,000 gpd/ft b = 600 ft. I = 0.01 Ne = 0.2

Aquifer Thickness (b)

The pertinent aquifer thickness is the saturated thickness of the aquifer. These values are expressed in units of feet.

Hydraulic Conductivity (K)

The hydraulic conductivity of an aquifer is the coefficient of proportionality describing the rate at which water can move through a permeable medium. (Fetter, 1988).

To allow ready comparison, all hydraulic conductivity data have been converted to gpd/ft^2 if the literature gave the value in units of ft/day. The converted values were not rounded.

Hydraulic Gradient (I)

In general terms, hydraulic gradient is a measure of the change of total head in any given direction (Fetter, 1988). The hydraulic gradient in the table is the change in total head in a horizontal distance. It is a dimensionless value because the units are length/length.

Effective Porosity (n_e)

Effective porosity is the volume of the void spaces through which water or other fluids can travel in a rock or sediment divided by the total volume of the porous medium.

DATA VALUE SELECTION

From the compilation of information, values for transmissivity, aquifer thickness, hydraulic conductivity, gradient, and effective porosity for each of the hydrogeologic settings were selected to calculate the basic wellhead protection areas.

The rationale for the selection of each of the values for five of the hydrogeologic settings are discussed in this section.

EASTERN SNAKE RIVER PLAIN BASALTS

Transmissivity:

The transmissivity value from IDWR - Energy Division data was selected for the following reasons:

1. There were sufficient data points located in the Eastern Snake River Plain Basalts from this study.

2. Data from a consistent source, if possible, were desirable for the calculations of the basic delineation for all the hydrogeologic settings. The Technical Task Force agreed that IDWR - Energy Division data would be the most consistent source of transmissivity data.

   The log mean transmissivity value calculated from IDWR - Energy Division data for the Eastern Snake River Plain Basalts was 352,091 gpd/ft, which was rounded to one significant figure, 400,000 gpd/ft. The Technical Task Force recognized that IDWR - Energy Division value did not fall within the transmissivity range compiled from the literature search. However, the decision was made to maintain the concept of using a consistent source of information. The Technical Task Force came to this conclusion after much debate and with the realization that the selection of any one value in an aquifer, such as the Eastern Snake River Plain Aquifer, with large magnitudes of variation in transmissivity will not ever be entirely representative of any given specific area. The overriding concept that led to the final decision was that the intent of the basic delineation approach is not to define specific wellhead protection areas, but rather is to develop guidelines for that aquifer.

Aquifer Thickness:

The value for aquifer thickness was derived by averaging the thickness range of 100 - 1000 feet and by rounding to one significant figure. The value of 4,000 feet was not believed to be a thickness relevant to the depth of drinking water supplies in this aquifer.

Hydraulic Conductivity:

The hydraulic conductivity value was calculated from the selected transmissivity and selected aquifer thickness value. Hydraulic conductivity would equal transmissivity divided by aquifer thickness.

Hydraulic Gradient:

The value for the hydraulic gradient was derived by averaging the range of .001 - .006 and by rounding to one significant figure.

Effective Porosity:

The value for the effective porosity was derived by averaging the range of .11 - .19.

COLUMBIA RIVER BASALTS

Transmissivity:

The transmissivity value from IDWR - Energy Division data was selected for the following reasons:

1. There were sufficient data points located in the Columbia River Basalts from this study.

2. Data from a consistent source, if possible, were desirable for the calculations of the basic delineation for all the hydrogeologic settings. The Technical Task Force agreed that IDWR - Energy Division data would be the most consistent source of transmissivity data.

The log mean transmissivity value calculated from IDWR - Energy Division data was 38,436 gpd/ft, which was rounded to 40,000 gpd/ft.

Aquifer Thickness:

The value for aquifer thickness was derived by averaging the range of 20 - 800 feet and by rounding to one significant figure.

Hydraulic Conductivity:

The hydraulic conductivity value was calculated from the selected transmissivity and selected aquifer thickness value. Hydraulic conductivity would equal the transmissivity divided by the aquifer thickness.

Hydraulic Gradient:

One reference for this value was found therefore this value, .0002, was selected.

Effective Porosity:

The value for effective porosity was derived by averaging the range of .004 - .19 and by rounding to one significant figure.

UNCONSOLIDATED ALLUVIUM

Transmissivity:

The transmissivity value from IDWR - Energy Division data was selected for these reasons:

1. There were sufficient data points for the unconsolidated alluvium aquifer type from this study.

2. Data from a consistent source, if possible, were desirable for the calculations of the basic delineation for all the hydrogeologic settings. The Technical Task Force agreed that IDWR - Energy Division data would be the most consistent source of transmissivity data.

The log mean transmissivity value calculated from IDWR - Energy Division data was 247,711 gpd/ft, which was rounded to 200,000 gpd/ft.

Aquifer Thickness:

The value of 100 feet was an estimation based on the typical depth of wells in this aquifer type.

Hydraulic Conductivity:

The hydraulic conductivity value was calculated from the selected transmissivity and selected aquifer thickness value. Hydraulic conductivity would equal the transmissivity divided by the aquifer thickness.

Hydraulic Gradient:

The value for the hydraulic gradient was derived by averaging the range of .003 - .02 and by rounding to one significant figure.

Effective Porosity:

The value for effective porosity was derived by averaging the range of .20 - .35 and by rounding to one significant figure.

MIXED VOLCANIC AND SEDIMENTARY ROCKS - PRIMARILY SEDIMENTARY ROCKS

Transmissivity

The transmissivity value from IDWR - Energy Division data was selected for these reasons:

1. There were sufficient data points for the unconsolidated alluvium aquifer type from this study.

2. Data from a consistent source, if possible, were desirable for the calculations of the basic elineation for all the hydrogeologic settings. The Technical Task Force agreed that IDWR - Energy Division data would be the most consistent source of transmissivity data.

The log mean transmissivity value calculated from IDWR - Energy Division data was 26,812 gpd/ft, which was rounded to 30,000 gpd/ft.

Aquifer Thickness:

The value for aquifer thickness was derived by averaging the thickness range of 500 - 1000 feet. At depths greater than 1000 feet it is very likely that the ground water encountered is geothermal and therefore, would not be used for drinking water purposes.

Hydraulic Conductivity:

The hydraulic conductivity value was calculated from the selected transmissivity and selected aquifer thickness value. Hydraulic conductivity would equal the transmissivity divided by the aquifer thickness.

Hydraulic Gradient:

The value for hydraulic gradient was derived by averaging the range of .002 - .004.

Effective Porosity:

The value for effective porosity was derived by averaging the range of .10 - .30.

MIXED VOLCANICS AND SEDIMENTARY ROCKS - PRIMARILY VOLCANIC ROCKS

Transmissivity:

The transmissivity value from the literature search was selected because there were not enough data points for this aquifer type from IDWR - Energy Division study.

The literature value of 374,000 gpd/ft was rounded to 400,000 gpd/ft.

Aquifer Thickness:

The value for aquifer thickness was derived by averaging the range of 500 - 600 feet and by rounding to one significant figure.

Hydraulic Conductivity:

The hydraulic conductivity value was calculated from the selected transmissivity and selected aquifer thickness value. Hydraulic conductivity would equal the transmissivity divided by the aquifer thickness.

Hydraulic Gradient:

The value for hydraulic gradient was derived by averaging the range of .012 - .015 and by rounding to one significant figure.

Effective Porosity:

The value for effective porosity was derived by averaging the range of .11 - .19 and by rounding to one significant figure.

DETERMINATION OF BASIC I TIME OF TRAVEL BOUNDARIES

Background

The radii calculations are based on advective transport and have taken into consideration the velocity of ground water around pumping wells and the velocity of the natural regional ground water flow. The calculated distance is in an upgradient direction from the well.

The derivation of the velocity of ground water flow around pumping wells is an additive process of the average linear velocity equation and the Theis equation. The average linear velocity is a velocity representing the rate at which water moves through the pore spaces. The Theis equation predicts the drawdown in hydraulic head in a confined aquifer at any distance "r" from a well at any time "t" after the start of pumping if the aquifer properties of transmissivity (T), storativity (S), and pumping rate (Q) are known.

Average linear velocity equation:

$$v = (K/n_e)(ds/dr)$$

where,

K = hydraulic conductivity, in gallons per day per ft^2 (gpd/ft^2)

n_e = effective porosity

(ds/dr)= hydraulic gradient around the well

Theis equation:

$$s = (Q/4\pi T) \int e^{-u}/u)du, \text{ where } u = (r^2S/4Tt) \text{ and } (du/dr) = (2rS/4Tt)$$

If the This equation is expanded and differentiated with respect to "r" , the factor, (ds/dr), can be substituted into the linear velocity equation to simplify the equation to:

$$v = (K/n_e)(Q/2\pi Tr)\, e^{(-r2S/4Tt)}$$

where,

Q = flow rate in gallons per day (gpd)

T = transmissivity in gallons per day per ft (gpd/ft)

r = distance between observation point and well in feet

S = storativity

s = drawdown in feet

t = time in days

At equilibrium, i.e. when "t" is very large, $e^{(-r2S/4Tt)}$ will approximate 1, so the velocity equation can be simplified to:

$$v = (K/n_e)(Q/2\pi Tr)$$

The velocity equation used to calculate the radius (including the conversion factor of 1 ft^3/day = 7.48 gal/day) is:

$$(K/7.48 \times n_e)(ds/dr) + (K/7.48 \times n_e)(Q/2\pi Tr)$$

A program has been developed to compute the distance from a wellhead that a particle would need to be in order to arrive at the wellhead in up to ten (10) years. The calculation assumes:

- That the well has been pumping at the specified flow rate for a very long tme such that an equilibrium velocity is established;
- a straight line from the point of origin of the parcel and the well; and
- that the regional groundwater flow is in the direction of the parcel flow.

Calculated radii for the various hydrogeologic settings and different pumping rates are given in Tables 4.8a - e in "Wellhead Protection Area Delineation," page 4-19 to 4-21.

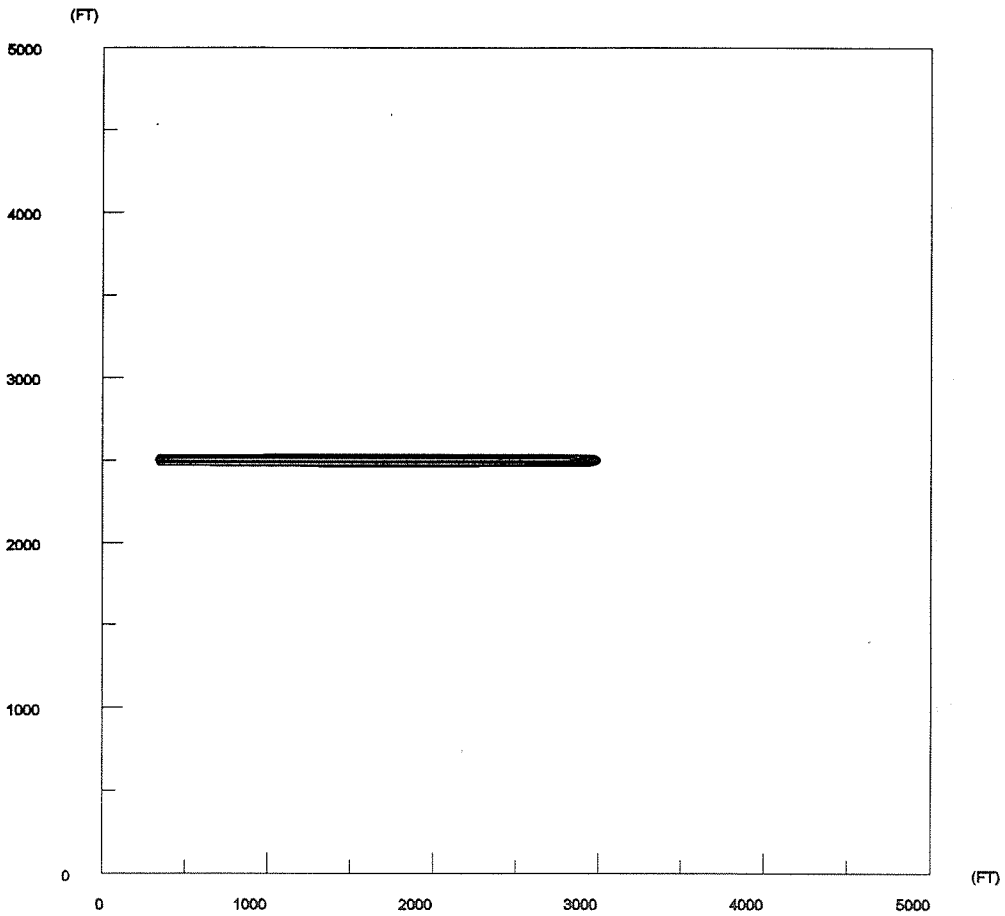
CODE VERIFICATION

The results of the calculations for the 3 year and the 6 year time of travel wellhead protection areas were spot checked with results calculated from the WHPA Code 2.0, which is a modular semi-analytical model developed by EPA.

The calculations for the 3 year and the 6 year wellhead protection areas are comparable

(See Figures F-1 through F-4).

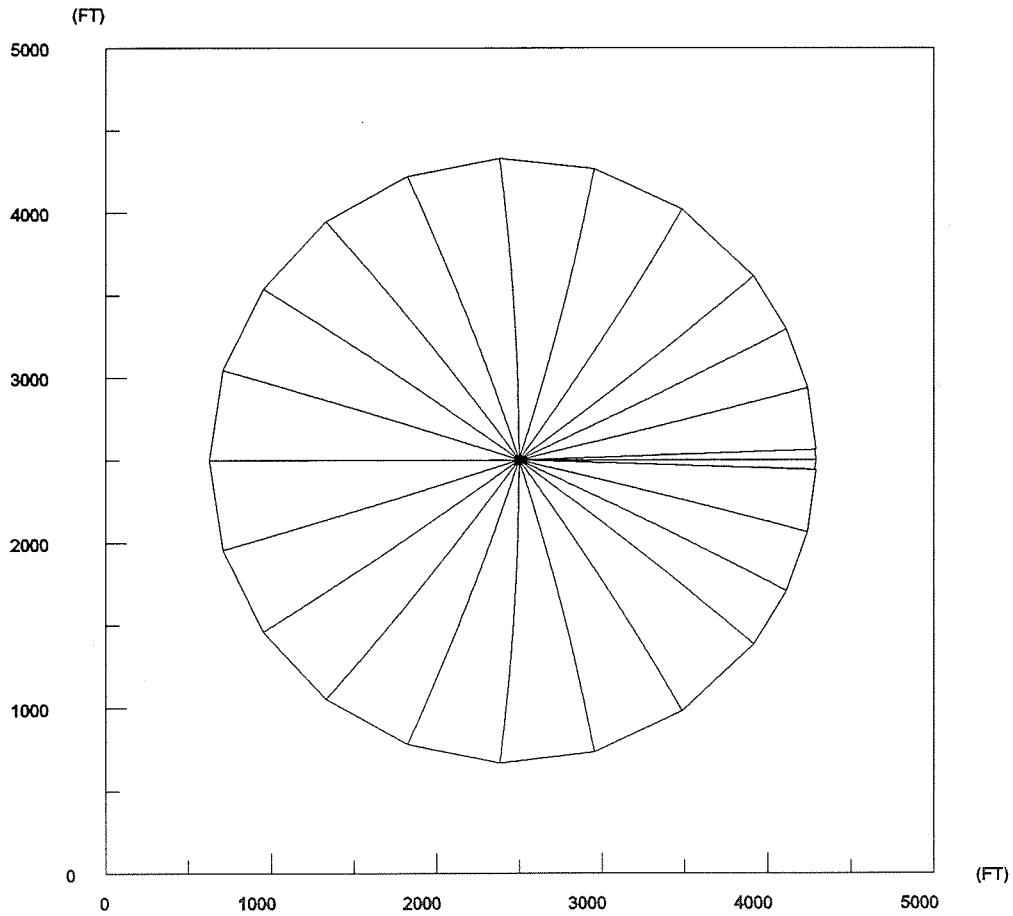
Figure F-1 WHPA Code Plot - East Snake River Plain Basalts



EAST SNAKE RIVER PLAIN BASALTS

Q = 144,000 GPD (100 GPM) = 19251 ft3/day
T = 400,000 gpd/ft = 53,476 ft2/day
b = 600 ft
i = 0.004
Ne = 0.15
Time of Travel = 3 years

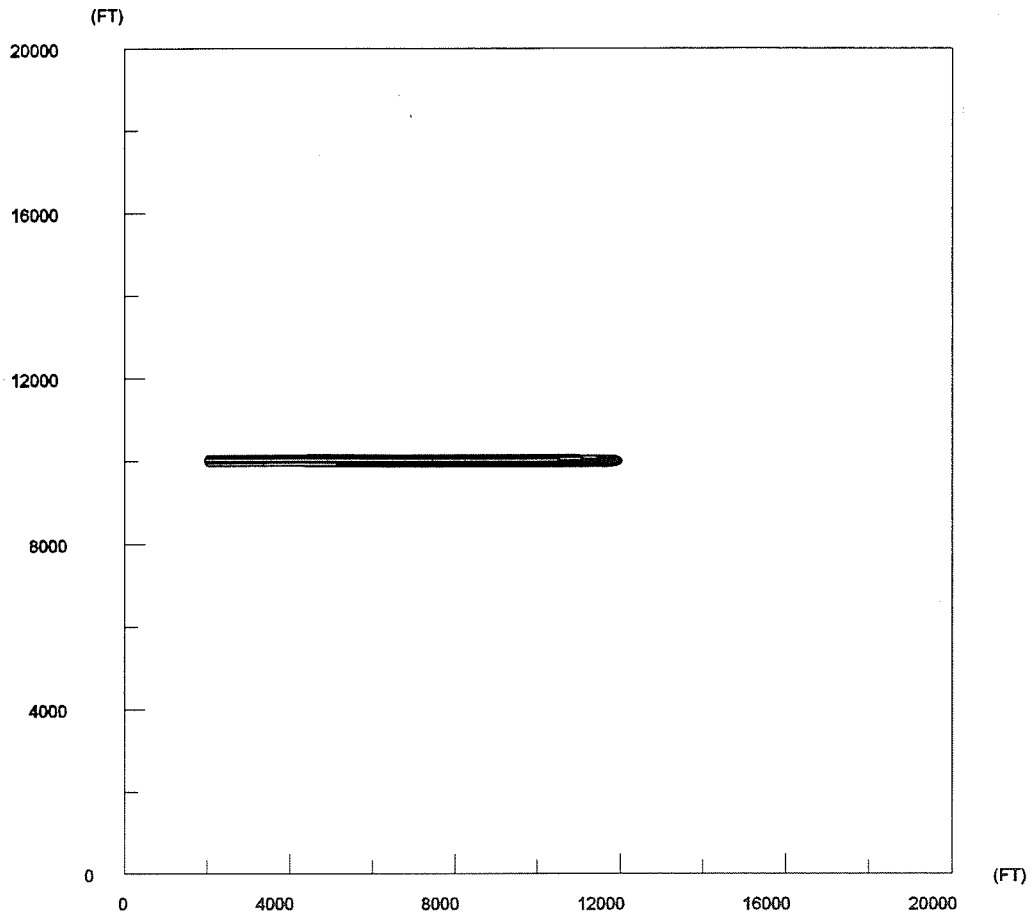
Figure F-2 WHPA Code Plot - Columbia River Basalts



COLUMBIA RIVER BASALTS

Q = 1,440,000 GPD (1000 GPM) = 192,513 ft^3/day
T = 40,000 gpd/ft = 5,348 ft^2/day
b = 400 ft
i = 0.0002
Ne = 0.1
Time of Travel = 6 years

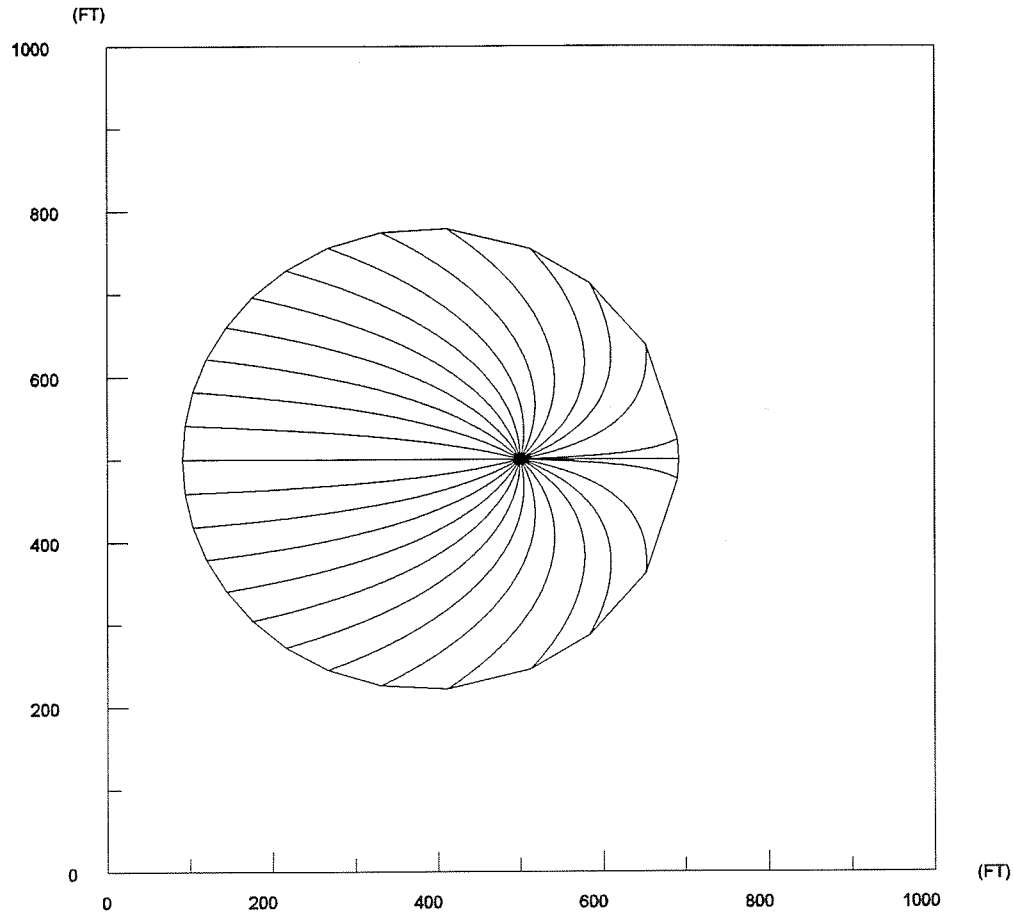
Figure F-3 WHPA Code Plot - Unconsolidated Alluvium



UNCONSOLIDATED ALLUVIUM

Q = 720,000 GPD (500 GPM) = 96,257 FT3/DAY
T = 200,000 gpd/ft = 26,738 ft2/day
b = 100 ft
i = 0.01
Ne = 0.3
Time of Travel = 3 years

Figure F-4 WHPA Code Plot - Mixed Volcanic and Sedimentary Rocks - Primarily Sedimentary Rocks



Mixed Volcanic and Sedimentary Rocks - Primarily Sedimentary Rocks

Q = 144,000 gpd (100 gpm) = 19251 ft3/day
T=30000 gpd/ft = 4010.7 ft2/day
b= 800 ft
i = 0.003
ne = 0.2
Time of Travel = 6 years = 2191 days

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